CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

4.0 ENVIRONMENTAL CONSEQUENCES

The impact analyses in this chapter focus on those areas where the potential exists for effects on the environment. Each of the alternatives (the No Action, Consolidation, and Consolidation with Bridge Alternatives) is discussed separately in Sections 4.1, 4.2, and 4.3, respectively. The cumulative impacts associated with the alternatives are presented in Section 4.4. Potential mitigation measures are described in Section 4.5. Resource commitments, including unavoidable adverse environmental impacts, the relationship between short-term use of the environment and long-term productivity, and irreversible and irretrievable commitments of resources, are presented in Section 4.6. A detailed discussion of each alternative is given in Chapter 2 of this environmental impact statement (EIS); a summary comparison of the environmental effects among alternatives is presented in Section 2.5.

In this *Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power Systems (Consolidation EIS)*, the impact analyses assess all disciplines where the potential exists for effects on the environment, as follows:

- Land resources
- Site infrastructure
- Geology and soils
- Water resources
- Air quality and noise
- Ecological resources
- Cultural resources
- Socioeconomics
- Public and occupational health and safety (associated with normal operations, facility accidents, and transportation)
- Environmental justice
- Waste management

These disciplines are analyzed in a manner commensurate with their importance under a specific alternative—the sliding-scale assessment approach. For example, under the No Action Alternative, the U.S. Department of Energy (DOE) has determined that minimal impacts would be associated with land resources, noise, water resources, geology and soils, ecological resources, and cultural and paleontological resources. This is because existing facilities in developed areas would be used, no new land disturbance would take place, and proposed activities would be consistent with current operations. Therefore, impacts associated with these resources are assessed for operations only. Where construction is an integral part of an alternative (i.e., the Consolidation and Consolidation with Bridge Alternatives), the impacts associated with such construction are included in the assessments. The sliding-scale assessment approach has been applied in the evaluation of all the alternatives addressed in this EIS.

The environmental consequence analyses associated with the alternatives assessed in this EIS were performed in accordance with the impact assessment methods described in Appendix B of this EIS. More detailed descriptions of the impacts development for the evaluation of human health effects are presented in

Appendix C and for transportation in Appendix D of this EIS. For consistency, numerical results are often rounded.

Analyses presented in the following sections include discussion of mitigation measures such as those that would be standard practice during facility construction. Section 4.5 presents a more detailed discussion of possible mitigation measures. Appropriate mitigation measures would be utilized to reduce or avoid impacts for each alternative.

4.1 No Action Alternative

A detailed description of the No Action Alternative is presented in Section 2.2.1 of this EIS.

Impacts of operations at the Fuel Manufacturing Facility (FMF) and Advanced Test Reactor (ATR) at Idaho National Laboratory (INL), and the High Flux Isotope Reactor (HFIR) and Radiochemical Engineering Development Center (REDC) at Oak Ridge National Laboratory (ORNL), are summarized from the *Final Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility (NI PEIS)* (DOE 2000f). Assembly and Testing Facility operational impacts are based on information presented in the *Finding of No Significant Impact and Final Environmental Assessment for the Future Location of the Heat Source/Radioisotope Power System Assembly and Test Operations Currently Located at the Mound Site (FONSI and Mound EA)* (DOE 2002c). Impacts of purification, pelletization, and encapsulation operations at the Plutonium Facility within Technical Area 55 (TA-55) at Los Alamos National Laboratory (LANL) are largely from the *Environmental Assessment for Radioisotope Heat Source Fuel Processing and Fabrication* (DOE 1991).

4.1.1 Land Resources

4.1.1.1 Land Use

All activities under the No Action Alternative would take place within existing facilities. There would be no change or effect on land use at INL, LANL, or ORNL, because no additional land would be disturbed, and the use of existing facilities would be compatible with their present missions (DOE 2000f).

4.1.1.2 Visual Environment

All activities under the No Action Alternative would take place within existing facilities. There would be no impact on visual resources since the current Visual Resource Management Class IV rating would not change.

4.1.2 Site Infrastructure

Utility infrastructure requirements under the No Action Alternative are summarized in **Table 4–1**. It is expected that electricity consumption, fuel consumption, and water use associated with storage of neptunium-237 in the existing FMF at the Materials and Fuels Complex (MFC) would be negligible. Also, there would be no additional utility requirements associated with irradiation of neptunium-237 targets in ATR and HFIR (should it be required), because these reactors are already in continuous operation for other purposes (DOE 2000f).

Table 4–1 Annual Incremental Infrastructure Requirements Associated with Operating Existing Facilities Under the No Action Alternative

Indicator	*INL*			*ORNL*		*LANL Plutonium Facility*
	FMF	*ATR* [a]	*SSPSF* [b]	*HFIR* [a]	*REDC*	
Electricity (megawatt-hours per year)	Negligible	0	2,039	0	Negligible	870
Natural gas (cubic meters per year)	0	0	0	0	0	78,000
Fuel oil (liters per year)	0	0	189,000	0	0	0
Water use (million liters per year)	0	0	28	0	2.9	0.19

INL = Idaho National Laboratory, ORNL = Oak Ridge National Laboratory, LANL = Los Alamos National Laboratory, FMF = Fuel Manufacturing Facility, ATR = Advanced Test Reactor, SSPSF = Space and Security Power Systems Facility, HFIR = High Flux Isotope Reactor, REDC = Radiochemical Engineering Development Center.

[a] There would be no incremental impacts of operation of ATR or HFIR because the insertion of targets does not affect reactor operating conditions.

[b] Also known as the Assembly and Testing Facility.

Note: To convert from cubic meters to cubic feet, multiply by 35.315; from liters to gallons, by 0.26418.

Sources: DOE 2000f, 2002c, 2003d.

Requirements for operation of the Assembly and Testing Facility are well within the current INL utility capacity. Annual electrical energy demands of some 2,039 megawatt-hours at the Assembly and Testing Facility are within INL's current electrical supply capacity of 481,800 megawatt-hours per year. The 189,000 liters (50,000 gallons) of fuel oil required to heat the facility is within the range of the 2 to 2.5 million liters (550,000 to 650,000 gallons) of total fuel oil burned each year at MFC. The annual water requirement of 28 million liters (7.3 million gallons) is within the capacity of the MFC water supply system and INL's water rights (DOE 2002c). The MFC system can deliver up to 1,790 million liters (473 million gallons) annually from its two deep wells (see Section 3.2.2.4). Information on current utility infrastructure usage and system capacities at INL is presented in Section 3.2.2.

Water requirements of 2.9 million liters (0.76 million gallons) per year at REDC is well within the capacity of the ORNL water supply system, which can deliver 9.7 billion liters (2.6 billion gallons) annually (see Section 3.4.2.4). Incremental electrical consumption for continued operations would be negligible (DOE 2000f). No additional fuel would be required because this facility is already being operated for other purposes. Information on current utility infrastructure usage and system capacities at ORNL is presented in Section 3.4.2.

The annual average electrical energy demand, an estimated 870 megawatt-hours for the Plutonium Facility at TA-55, is within LANL's current electrical supply capacity of 963,600 megawatt-hours per year. The 78,000 cubic meters (2.8 million cubic feet) of natural gas estimated to be required is a small percentage of the 38 million cubic meters (1.3 billion cubic feet) of natural gas used each year at LANL. The annual water requirement of 0.19 million liters (0.05 million gallons) is well within the capacity of the Los Alamos water supply system. Information on current infrastructure utility usage and system capacities at LANL is presented in Section 3.3.2.

4.1.3 Geology and Soils

All activities under the No Action Alternative would take place within existing facilities. There would be no disturbance to either geologic or soil resources.

Hazards from large-scale geologic conditions at INL, such as earthquakes and volcanoes, were previously evaluated in the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* (*Storage and Disposition PEIS*) (DOE 1996d). The analysis determined that these hazards present a low risk to long-term storage facilities. Further review of the data and analyses presented in the referenced document and the site-specific data presented in the *NI PEIS* (DOE 2000f) indicates that large-scale geologic conditions likewise present a low risk to the proposed INL facilities. Ground shaking of Modified Mercalli Intensity VI to VII (see Table B–7) at INL associated with postulated earthquakes is expected to primarily affect the integrity of inadequately designed or nonreinforced structures. Damage to properly or specially-designed or upgraded facilities is not expected. Also, the likelihood of future volcanic activity during the 35-year operational period evaluated under the No Action Alternative is considered low. The potential for other nontectonic events to affect INL facilities is also low (DOE 2000f).

Hazards from large-scale geologic conditions at ORNL, were previously evaluated in the *Storage and Disposition PEIS* (DOE 1996d). The analysis determined that these hazards present a low risk to long-term storage facilities. Further review of the data and analyses presented in the referenced document and the site-specific data presented in the *NI PEIS* (DOE 2000f) indicates that large-scale geologic conditions likewise present a low risk to HFIR and REDC operations. This is based on the fact that there is no evidence of capable (active) faults on or near ORNL, and no volcanic hazard exists. While sinkholes are present in the Knox Group, the 7900 Area is underlain by the Conasauga Group, in which karst features are less well developed. Thus, sinkholes do not present a geologic hazard to HFIR. The analysis determined that these hazards present a low risk to specially-designed or upgraded facilities such as HFIR (DOE 2000f).

4.1.4 Water Resources

Estimated water use and wastewater generation under the No Action Alternative are summarized in **Table 4–2**. There would be no impact on water resources associated with operations in FMF, ATR and HFIR (should it be required), because there would be no additional incremental use of surface water or groundwater, and there would be no change in the quantity or quality of effluents discharged to surface water or groundwater. ATR and HFIR are already in operation for other purposes, so neptunium-237 target irradiation would not have measurable impacts (DOE 2000f).

Table 4–2 Annual Incremental Water Use and Wastewater Generation Associated with Operating Existing Facilities Under the No Action Alternative

Indicator (million liters per year)	*INL*			*ORNL*		*LANL Plutonium Facility*
	FMF	*ATR* [a]	*SSPSF* [b]	*HFIR* [a]	*REDC*	
Water use	0	0	28	0	2.9	0.19
Process wastewater generation	0	0	0	0	0.023	< 0.0012
Sanitary wastewater generation	0	0	28 [c]	0	2.9	0.19

INL = Idaho National Laboratory, ORNL = Oak Ridge National Laboratory, LANL = Los Alamos National Laboratory, FMF = Fuel Manufacturing Facility, ATR = Advanced Test Reactor, SSPSF = Space and Security Power Systems Facility, HFIR = High Flux Isotope Reactor, REDC = Radiochemical Engineering Development Center.

[a] There would be no incremental impacts of operation of ATR or HFIR because the insertion of targets does not affect reactor operating conditions.

[b] Also known as the Assembly and Testing Facility.

[c] Assumes all water used becomes sanitary wastewater.

Note: To convert from liters to gallons, multiply by 0.26418.

Sources: DOE 2000f, 2002c.

Operation of the Assembly and Testing Facility would require approximately 28 million liters (7.3 million gallons) of water annually. Sanitary wastewater would be treated in the INL sewage lagoons. The waste streams from the Assembly and Testing Facility are within the capacity of these facilities (DOE 2002c). Information on current water usage, effluent discharge, and water quality at INL is presented in Section 3.2.4.

As summarized in Table 4–2, water use and sanitary wastewater generation would be relatively small and largely associated with staffing requirements at REDC at ORNL and the Plutonium Facility at LANL. The only other measurable wastewater generation would be 23,000 liters (6,100 gallons) per year of process wastewater associated with target processing at REDC and 1,130 liters (300 gallons) per year of radioactive liquid process wastewater from the Plutonium Facility (DOE 1991). Specifically, the 23,000 liters (6,100 gallons) of process wastewater generated per year would be negligible relative to the total volume of process wastewater generated and treated at the ORNL Process Waste Treatment Complex (DOE 2000f). In addition, the 1,130 liters (300 gallons) per year of radioactive liquid process wastewater is negligible relative to the total volume of process wastewater treated and discharged from the LANL Radioactive Liquid Waste Treatment Facility annually (11 million liters [3.0 million gallons]) (LANL 2004a). Impacts on the quantity or quality, if any, of process and sanitary wastewater discharges would be very small, with no radiological liquid effluent discharges to the environment under normal operations. Overall, no measurable impact on water resources at ORNL and LANL are expected.

4.1.5 Air Quality and Noise

4.1.5.1 Air Quality

Nonradiological Releases

It is estimated that there would be no measurable nonradiological air pollutant emissions at INL and ORNL associated with operations in FMF, ATR and HFIR (should it be required). Therefore, there would be no nonradiological air quality impacts at INL or ORNL associated with these activities (DOE 2000f).

The primary source of criteria pollutant emissions due to continued operation of the Assembly and Testing Facility would be from burning fuel oil in the boilers that provide heat and power for the facilities at INL. Each of the boilers has specific limits on the levels of emissions. Continued operation of the Assembly and Testing Facility would not cause the boilers to exceed their permitted levels of nitrogen oxide emissions and other air pollutants (DOE 2002c).

The nonradiological air pollutant concentrations at ORNL from activities at REDC are presented in **Table 4–3**. Concentrations are based on a dispersion-modeling screening analysis conducted with maximum expected emission rates and a set of worst-case meteorological conditions. Criteria pollutants were modeled for a stack height of 76.2 meters (250 feet) at the boundary limit of 5.0 kilometers (3.1 miles). Only those air pollutants expected to be emitted that have ambient air quality standards are presented in the table. The concentrations were determined to be small and would be below applicable standards even when ambient monitored values and the contributions from other site activities were included (DOE 2000f). Health effects of hazardous chemicals associated with this alternative are addressed in Section 4.1.9.

Table 4–3 Incremental Oak Ridge National Laboratory Air Pollutant Concentrations Associated with Operating Existing Facilities Under the No Action Alternative

Pollutant	*Averaging Period*	*Most Stringent Standard or Guideline (micrograms per cubic meter)*	*Modeled Increment (micrograms per cubic meter)*
Nitrogen dioxide	Annual	100	0.000199
Sulfur dioxide	Annual 24 hours 3 hours	80 365 1,300	0.04 0.31 0.70

Source: Modeled increments are based on the SCREEN3 computer code (DOE 2000f).

The primary source of criteria pollutant emissions from LANL's Plutonium Facility would be from burning natural gas to provide heat. Each of the boilers has specific limits on the levels of emissions. Operations in the Plutonium Facility would not cause the boilers to exceed their permitted levels of emissions. The contributions to ambient concentrations attributable to purification, pelletization, and encapsulation operations would be minor.

The air pollutant emissions from operations under this alternative would be small and not subject to Prevention of Significant Deterioration (PSD) regulations. Therefore, a PSD increment analysis is not required (see Section B.4.1).

The Final Rule for "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" requires a conformity determination for certain-sized projects in nonattainment areas. DOE has performed a review for this alternative and concluded that a conformity determination is not necessary to meet the requirements of the Final Rule, because INL, ORNL, and LANL are located in attainment areas for all criteria pollutants, except for ozone and particulate matter (PM) with an aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$) at ORNL, and threshold emission levels would not be exceeded by the activities considered (DOE 2000a). See Section D.5.2 for a discussion of the human health risks from pollutants emitted by transport vehicles.

Radiological Releases

Radioactive releases associated with storage of neptunium-237 at FMF would be essentially zero, as the canisters containing the neptunium-237 would remain in containment vessels during storage. Incremental releases to the environment from ATR and HFIR (should it be required) during target irradiation would be zero, because there would be no increase in activities in those reactors due to additional target irradiation. An estimated 1.7×10^{-7} curies per year of plutonium-238 could be released to the environment during target fabrication and post-irradiation processing operations at REDC if the No Action Alternative is implemented (see Section C.2.1.4). An estimated 1.0×10^{-8} curies per year of plutonium-238 could be released to the environment from purification, pelletization, and encapsulation operations at LANL's Plutonium Facility. No releases are expected from the radioisotope power system (RPS) Assembly and Testing Facility at INL, because the facility would handle only fully encapsulated radioactive material. There would be no other types of radiological releases from RPS nuclear production operations. Impacts of radiological releases are discussed in Section 4.1.9.

4.1.5.2 Noise

Operations in FMF and the Assembly and Testing Facility at MFC, and the ATR at the Reactor Technology Complex (RTC) (formerly Test Reactor Area), would generate noise levels similar to those presently associated with operations conducted in these areas of INL. Onsite noise impacts are expected to be minimal, and offsite noise levels should not be noticeable, as the nearest site boundary is 6.4 kilometers (4 miles) from MFC and 11 kilometers (6.8 miles) from RTC. Traffic increases would be small and would result in only minor on- and offsite noise levels. There would be no loud noises associated with these operations that would adversely impact wildlife (DOE 2000f, 2002c).

Noise associated with operations in REDC and HFIR (should it be required) would be similar to sound levels associated with current operations, as well as other operations conducted at ORNL. Onsite noise impacts are expected to be minimal, and offsite noise levels would not be noticeable because the nearest site boundary is 2.5 kilometers (1.6 miles) to the southeast. Traffic increases would be minor and would not lead to noticeable noise levels either on or offsite. There would be no loud noises associated with these operations that would adversely impact wildlife (DOE 2000f).

Noise associated with operations in the Plutonium Facility at LANL would be similar to sound levels generated by present Plutonium Facility operations, as well as other operations in TA-55. Onsite noise impacts are expected to be minimal, and offsite noise levels would not be noticeable. Traffic associated would be minor and would not lead to noticeable noise levels either on or offsite. There would be no loud noises associated with these operations that would adversely impact wildlife.

4.1.6 Ecological Resources

All activity under the No Action Alternative would take place within existing facilities; therefore, direct disturbance to ecological resources at INL, ORNL, and LANL would not occur. As noted in Section 4.1.5.2, wildlife would not be affected by noise associated with operations at these facilities. There would be no impact on wetlands or aquatic resources because there would be no construction, no increase in water usage, and no direct discharge of wastewater (Section 4.1.4). Because of the developed nature of the areas and the fact that no new construction would take place, impacts on threatened and endangered species would not occur (DOE 2000f).

Measurable impacts on populations of plants and animals on or off the DOE sites are not expected as a result of the incremental increase in exposure to radionuclides or chemicals that could result from operation of facilities under this alternative. DOE routinely samples game species residing on or near the sites, livestock in the region, locally grown crops, and milk for radionuclides. The results of this monitoring are reported in the annual environmental reports prepared for each site. Concentrations of radionuclides in the plant and animal samples are generally small and seldom higher than concentrations observed at control locations distant from the sites. Additional deposition resulting from implementation of this alternative is not expected to lead to levels of contaminants that would exceed the historically reported ranges of concentrations. Therefore, DOE anticipates minimal impacts on the ecology of the DOE sites, and on plant and animal populations, as a result of exposure to radionuclides or chemicals under this alternative.

4.1.7 Cultural Resources

All facilities located at INL (FMF, ATR, and the Assembly and Testing Facility), as well as the Plutonium Facility at LANL and HFIR at ORNL, are existing structures and would not require modification under this alternative. REDC at ORNL would require some internal modifications, but no land disturbance is expected. As no new land disturbance would occur and all building modifications would be internal, no impacts on prehistoric, historic, or American Indian cultural resources at INL, LANL, or ORNL are expected.

4.1.8 Socioeconomics

Under the No Action Alternative, current levels of employment at the INL MFC and LANL's Plutonium Facility would remain unchanged. As no new employment or in-migration of workers would be required, socioeconomic conditions around INL and LANL would remain unchanged. Also, no additional workers would be required for irradiation of neptunium-237 targets in ATR at INL or HFIR (should it be required) at ORNL, as these reactors are in operation and already irradiate targets for other customers.

As noted in the *NI PEIS*, target fabrication and post-irradiation processing of neptunium-237 targets at ORNL's REDC would require about 41 workers. This level of employment was estimated to generate approximately 105 additional jobs in the region around ORNL. Assuming these are new jobs to the region, the potential increase of 146 jobs would represent a less than 0.1 percent increase in the workforce. An increase in employment of this size and other related economic activity in support of RPS nuclear production operations at ORNL would have no noticeable impact on socioeconomic conditions in the ORNL region of influence (ROI) (DOE 2000f).

Since employment in support of RPS nuclear production operations at INL and LANL would not change, traffic volumes would not change. The increase in traffic volume at ORNL from RPS nuclear production at REDC would be small and not likely to be noticed by commuters in the vicinity of ORNL.

4.1.9 Public and Occupational Health and Safety

Assessments of radiological and chemical impacts associated with the No Action Alternative are presented in this section. Supplemental information is provided in Appendix C of this EIS.

4.1.9.1 Construction and Normal Operations

No construction activities are associated with the No Action Alternative. During normal operations, there could be incremental radiological and hazardous chemical releases to the environment and also incremental direct in-plant exposures. The resulting doses and potential health effects on the public and workers under this alternative are described below.

Radiological Impacts

Incremental radiological doses to three receptor groups from operations at INL, ORNL, and LANL are given in **Table 4–4**: the population within 80 kilometers (50 miles) in the year 2050, the maximally exposed individual (MEI) of the public, and the average exposed member of the public. The projected number of excess latent cancer fatalities (LCFs) in the surrounding population and the excess LCF risk to the MEI and average exposed individual are also presented in the table. A probability coefficient of 6×10^{-4} LCFs per rem (roentgen equivalent man) is applied for the public and workers.

Table 4–4 Incremental Radiological Impacts on the Public of Facility Operations Under the No Action Alternative

Receptor	*INL*		*ORNL*		*LANL*
	MFC [a]	*ATR* [b]	*HFIR* [b]	*REDC*	*Plutonium Facility*
Population within 80 kilometers (50 miles) in the year 2050					
Dose (person-rem)	1.7×10^{-6}	No change	No change	1.5×10^{-4}	1.8×10^{-5}
35-year period excess latent cancer fatalities	3.5×10^{-8}	No change	No change	3.2×10^{-6}	3.8×10^{-7}
Maximally exposed individual					
Annual dose (millirem)	1.4×10^{-7}	No change	No change	4.5×10^{-6}	1.0×10^{-6}
35-year excess latent cancer fatality risk	2.9×10^{-12}	No change	No change	9.5×10^{-11}	2.1×10^{-11}
Average exposed individual within 80 kilometers (50 miles)					
Annual dose [c] (millirem)	4.7×10^{-9}	No change	No change	1.1×10^{-7}	3.0×10^{-8}
35-year excess latent cancer fatality risk	9.9×10^{-14}	No change	No change	2.2×10^{-12}	6.3×10^{-13}

INL = Idaho National Laboratory, ORNL = Oak Ridge National Laboratory, LANL = Los Alamos National Laboratory, MFC = Materials and Fuels Complex, ATR = Advanced Test Reactor, HFIR = High Flux Isotope Reactor, REDC = Radiochemical Engineering Development Center.

[a] Because exposure data are not available for neptunium-237 storage exclusively, values were conservatively estimated to be 10 percent (DOE 2000f) of the fabrication and processing component of the total neptunium-237 target fabrication, processing, and storage doses at REDC. These values serve as an upper-bound representation of the potential impacts that could be incurred from neptunium-237 storage.

[b] There would be no incremental radiological impacts of operation of ATR or HFIR because the insertion of targets does not affect reactor operating conditions or contribute a new source of radiological emissions.

[c] Obtained by dividing the population dose by the number of people projected to live within 80 kilometers (50 miles) of the site in the year 2050 (ATR at INL = 172,200; MFC at INL = 355,000; REDC and HFIR at ORNL = 1,438,000; Plutonium Facility at LANL = 608,800).

Source: DOE 2000f.

Doses at INL would be attributed to storage of the neptunium-237 targets. Assembly and Testing Facility operations at MFC are not expected to release any radioactivity on or offsite because the facility would handle only fully encapsulated radioactive material. Doses at ORNL would be attributed to target fabrication and post-irradiation processing at REDC. Doses at LANL would be attributed to purification, pelletization, and encapsulation activities at the Plutonium Facility in TA-55. There would be no incremental dose and no excess LCFs from operations at ATR and HFIR (should it be required) because there would be no increase in radiological releases to the environment from either of these reactors associated with this alternative (DOE 2000f).

The highest population, MEI, and average exposed individual doses would occur at ORNL from activities at REDC. The annual population dose at ORNL would be 1.5×10^{-4} person-rem, with a 35-year excess LCF risk of a 3.2×10^{-6}. The annual MEI dose would be 4.5×10^{-6} millirem, with a 35-year excess LCF risk of 9.5×10^{-11}. The annual average exposed individual dose would be 1.1×10^{-7} millirem, with a 35-year excess LCF risk of 2.2×10^{-12}.

Doses to involved workers from normal operations are given in **Table 4–5**; these workers are defined as those directly associated with process activities. The incremental annual average dose to workers from irradiation activities at ATR and HFIR would be negligible; to REDC, FMF, and Plutonium Facility workers, approximately 170 (DOE 2000f), 17, and 240 (LANL 2005) millirem, respectively. No LCFs would be expected from these exposures. Doses to individual workers would be kept to minimal levels by instituting badged monitoring and "as low as is reasonably achievable" (ALARA) programs.

Table 4–5 Incremental Radiological Impacts on Involved Workers of Facility Operations Under the No Action Alternative

Receptor – Involved Workers [a]	*INL*		*ORNL*		*LANL Plutonium Facility*
	MFC [a]	*ATR* [b]	*HFIR* [b]	*REDC*	
Total dose (person-rem per year)	1.2 [c]	No change	No change	12 [d]	19 [e]
35-year excess latent cancer fatalities	0.025	No change	No change	0.25	0.4
Average worker dose (millirem per year)	17	No change	No change	170	240
35-year excess latent cancer fatality risk	0.00036	No change	No change	0.0036	0.005

INL = Idaho National Laboratory, ORNL = Oak Ridge National Laboratory, LANL = Los Alamos National Laboratory, MFC = Materials and Fuels Complex, ATR = Advanced Test Reactor, HFIR = High Flux Isotope Reactor, REDC = Radiochemical Engineering Development Center.

[a] The radiological limit for an individual worker is 5,000 millirem per year (10 *Code of Federal Regulations* [CFR] 835). However, the maximum dose to a worker involved with radiological operations would be kept below the DOE Administrative Control Level of 2,000 millirem per year (DOE 1999e). Further, DOE recommends that facilities adopt a more limiting, 500-millirem-per-year, Administrative Control Level (DOE 1999e). To reduce doses to ALARA levels, an effective ALARA program would be enforced (see Section 4.5.5).

[b] There would be no incremental radiological impacts of operation of ATR or HFIR because the insertion of targets does not affect reactor operating conditions or contribute a new source of radiological emissions.

[c] Because exposure data are not available for neptunium-237 storage exclusively, values are conservatively estimated to be 10 percent (DOE 2000f) of the total dose from neptunium-237 target fabrication/processing and neptunium-237 storage, and serve as an upper-bound representation of the potential impacts that could be incurred from neptunium-237 storage.

[d] Based on an estimated 75 badged workers.

[e] Based on an estimated 79 badged workers and an average of 0.24 rem per worker at LANL (LANL 2005).

Hazardous Chemical Impacts

Hazardous chemical impacts at INL would be unchanged from baseline site operations because no new chemicals would be emitted to the air from storage of neptunium-237 in FMF at MFC or irradiation of neptunium-237 targets in ATR at INL and HFIR at ORNL (DOE 2000f).

Carcinogenic and noncarcinogenic health effects of exposure to hazardous chemicals emitted from operations in REDC at ORNL were evaluated and reported in the *NI PEIS* (DOE 2000f). The hazardous chemical health effects are summarized in **Table 4–6**. The Hazard Index for activities at ORNL is estimated to be much less than 1 (0.006), and the cancer risk to be less than 1 in 1 million. Therefore, no chemical health effects are anticipated under the No Action Alternative.

Nonradioactive air emissions from activities at the Plutonium Facility at LANL would be mainly from the glovebox gases argon and helium. These are inert and nonhazardous. Ethanol, used as a solvent at LANL, is likewise not hazardous. Vapors of hydrofluoric and nitric acids, used in decontamination, would be emitted at rates well below threshold values (DOE 1991).

Table 4–6 Incremental Hazardous Chemical Impacts on the Public around Oak Ridge National Laboratory Under the No Action Alternative

Chemical	*Modeled Annual Increment (milligrams per cubic meter)*	*RfC to Inhalation (milligrams per cubic meter)*	*Unit Cancer Risk (risk per milligram per cubic meter)*	*Hazard Quotient*	*Cancer Risk*
REDC at ORNL					
Diethyl benzene	3.37×10^{-5}	1	7.8×10^{-3}	3.37×10^{-5}	2.63×10^{-7}
Methanol	1.23×10^{-6}	1.75	NA	7.03×10^{-7}	NA
Nitric acid	1.53×10^{-6}	0.123	NA	1.25×10^{-5}	NA
Tributyl phosphate	6.34×10^{-5}	0.01	NA	6.34×10^{-3}	NA
			Hazard Index =	6.39×10^{-3}	

RfC = reference concentration, NA = not applicable (the chemical is not a known carcinogen or it is a carcinogen and only unit risk will apply).

Note: For diethyl benzene, the RfC for ethyl benzene and the unit cancer risk for benzene were used to estimate Hazard Quotient and cancer risk because no information was available for diethyl benzene. For tributyl phosphate, the RfC for phosphoric acid was used to estimate the Hazard Quotient because no information was available for tributyl phosphate.

Source: DOE 2000f.

4.1.9.2 Facility Accidents

This section discusses potential accident impacts under the No Action Alternative. Detailed descriptions are provided in Appendix C of this EIS. The accident scenarios chosen for analysis have impacts that bound the suite of accidents that have occurred and could occur at the facilities. The selection of accident scenarios described in Appendix C of this EIS include the review of accident history as presented in Sections 3.2.9.4, 3.3.9.4, and 3.4.9.4. The accident scenarios that were analyzed result in higher public and noninvolved worker risks than historic accidents.

Incremental radiological doses to three receptor groups from postulated accidents at INL, ORNL, and LANL are estimated: the population within 80 kilometers (50 miles), the MEI of the public, and the noninvolved worker. The projected number of excess LCFs in the surrounding population and the excess LCF risk to the MEI and noninvolved worker are also presented. A probability coefficient of 6×10^{-4} LCFs per rem is applied for the public and workers.

Radiological Impacts

Potential accidents under the No Action Alternative have been evaluated by DOE in previous National Environmental Policy Act (NEPA) documents (DOE 2000f, 2002c).

Neptunium-237 Storage—At INL, neptunium-237 would be stored in the FMF vault. While the postulated beyond-evaluation-basis earthquake may cause portions of the facility to collapse, the storage cans would not be stressed to a level that would breach the double containment of the can design (DOE 2000f).

Target Irradiation—For ATR target irradiation accidents, the annual increased risk of an LCF to the offsite MEI and a noninvolved worker associated with plutonium-238 production would be 3.0×10^{-8} and 3.0×10^{-7}, respectively. The annual risk in terms of the increased number of LCFs in the surrounding population would be 2.6×10^{-3} (DOE 2000f).

For HFIR target irradiation accidents, the annual increased risk of an LCF to the offsite MEI and a noninvolved worker associated with plutonium-238 production would be 1.7×10^{-7} and 6.9×10^{-7}, respectively. The annual risk in terms of the increased number of LCFs in the surrounding population would be 1.5×10^{-4}. These target irradiation accident risks were calculated in the *NI PEIS* (DOE 2000f).

Target Fabrication and Post-irradiation Processing—For REDC target fabrication and processing accidents, the annual increased risk of an LCF to the offsite MEI and a noninvolved worker was estimated to be 1.6×10^{-6} and 1.0×10^{-5}, respectively. The annual accident risk in terms of the increased number of LCFs in the surrounding population was estimated to be 4.5×10^{-3}.

Assembly and Testing Operations—A range of accidents were considered for the Assembly and Testing Facility, including welding fire accidents, catastrophic failure of one or more of the fuel elements, and the potential for a wind-driven missile to penetrate a facility wall and glovebox. However, because of the solid ceramic form of the plutonium and the multiple protective features of the Category 3 building, any release to the environment from these accidents would be negligible. Any adverse effects would be mitigated by air filtration systems, room and building barriers, and air locks that contain releases (DOE 2002c). Because the probability of occurrence and, release of radioactive materials outside of the building for these accidents was estimated to be less than 1 in 1 million per year, the risks to noninvolved workers and the public were not considered further.

Plutonium-238 Purification, Pelletization, and Encapsulation—The consequences and risks of plutonium-238 purification, pelletization, and encapsulation accidents are shown in **Table 4–7**. Four potential accidents were postulated:

- An unmitigated evaluation-basis fire during plutonium-238 powder-to-pellet fabrication. Unmitigated conditions assume failure of heating, ventilating, and air conditioning (HVAC) and fire suppression systems. The estimated frequency of this accident is 1×10^{-5} per year.

- An unmitigated evaluation-basis earthquake (0.3-g[1] acceleration), causing failure of the HVAC, fire safety equipment, nonsafety-class ductwork, and internal nonsafety-grade structures, but not the structure shell itself. The estimated frequency of this accident is 5×10^{-4} per year.

- A beyond-evaluation-basis fire similar to the evaluation-basis fire, but involving two gloveboxes and the assumption that exterior doors are open for the duration of the fire, providing a direct unfiltered release to the environment. The estimated frequency of this accident is 1×10^{-6} per year.

- A beyond-evaluation-basis earthquake (0.5-g), with all the same assumed failures as the evaluation basis earthquake but in addition, a 50-percent degradation in high-efficiency particulate air (HEPA) filter removal efficiency. The estimated frequency of this accident is 1×10^{-4} per year.

The risks of the postulated accidents are shown in **Table 4–8**. The accident with the highest risk is an unmitigated evaluation-basis earthquake. If this accident were to occur, the annual risk of an LCF would be 1.4×10^{-7} and 2.3×10^{-6} for the MEI and noninvolved worker, respectively. The annual risk for the offsite population would be 2.5×10^{-4}. The 35-year risk for the highest-consequence accident, an unmitigated evaluation-basis earthquake, for the MEI, noninvolved worker, and offsite population would be 4.9×10^{-6}, 8.1×10^{-5}, and 0.0088, respectively.

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[1] *In measuring earthquake ground motion, the acceleration (the rate of change in velocity) experienced relative to that due to Earth's gravity (i.e., approximately equal to 980 centimeters per second squared).*

Table 4–7 Plutonium-238 Purification, Pelletization, and Encapsulation Annual Accident Consequences at Los Alamos National Laboratory Under the No Action Alternative

Accident	*Maximally Exposed Individual*		*Population to 80 Kilometers (50 miles)*		*Noninvolved Worker*	
	Dose (rem)	*Latent Cancer Fatality* [a]	*Dose (person-rem)*	*Latent Cancer Fatalities* [b]	*Dose (rem)*	*Latent Cancer Fatality* [a]
Unmitigated evaluation-basis fire	10.2	0.0061	1,850	1.11	15.9	0.0095
Unmitigated evaluation-basis earthquake	4.70	0.0028	834	0.50	7.64	0.0046
Beyond-evaluation-basis fire	5.37	0.0032	675	0.41	8.04	0.0048
Beyond-evaluation-basis earthquake	0.72	0.00043	165	0.10	1.17	0.00070

[a] Likelihood of an LCF.
[b] Number of LCFs.

Table 4–8 Plutonium-238 Purification, Pelletization, and Encapsulation Annual Accident Risks at Los Alamos National Laboratory Under the No Action Alternative

Accident	*Maximally Exposed Individual* [a]	*Population to 80 Kilometers* [b] *(50 miles)*	*Noninvolved Worker* [a]
Unmitigated evaluation-basis fire	6.1×10^{-8}	1.1×10^{-5}	9.5×10^{-8}
Unmitigated evaluation-basis earthquake	1.4×10^{-7}	2.5×10^{-4}	2.3×10^{-6}
Beyond-evaluation-basis fire	3.2×10^{-9}	4.1×10^{-7}	4.8×10^{-9}
Beyond-evaluation-basis earthquake	4.3×10^{-8}	9.9×10^{-6}	7.0×10^{-8}

[a] Increased likelihood of an LCF.
[b] Increased number of LCFs.

Chemical Impacts

Storage of neptunium-237 would not involve hazardous chemicals. Therefore, no chemical accidents would be associated with storage of neptunium-237 in FMF (DOE 2000f).

Irradiation of neptunium-237 targets at ATR and HFIR (should it be required) would not introduce any additional hazardous chemicals. Thus, no postulated chemical accidents would be attributable to irradiation of neptunium-237 targets (DOE 2000f).

Target processing associated with plutonium-238 production at REDC, including storage of neptunium-237 and plutonium-238; neptunium-237 target fabrication; and post-irradiation processing to extract plutonium-238 and to recycle the unconverted neptunium-237 into new targets would not require any chemicals that are not already in use in the facility. The quantities of in-process hazardous chemicals for the plutonium-238 production program would be bounded by the quantities of the material currently stored in the facility. Therefore, the impacts of in-process hazardous chemical accidents associated with plutonium-238 production would be bounded by the impacts of hazardous chemical accidents associated with existing chemical storage facilities at REDC (DOE 2000f).

Plutonium-238 purification, pelletization, and encapsulation would not require the use of hazardous chemicals.

4.1.9.3 Transportation

Transportation impacts consist of impacts of incident-free or routine transportation and impacts of transportation accidents. Incident-free transportation impacts include radiological impacts on the public and workers from the radiation field surrounding the transportation package. Nonradiological impacts of potential transportation accidents include traffic accident fatalities. See Section D.5.2 for a discussion of the human health risks from pollutants emitted by transport vehicles.

The impact of a specific radiological accident is expressed in terms of probabilistic risk, which is defined as the accident probability (i.e., accident frequency) multiplied by the accident consequences. The overall risk is obtained by summing the individual risks from all reasonably conceivable accidents. The analysis of accident risks takes into account a spectrum of accidents ranging from high-probability accidents (fender bender) of low consequence to high-consequence accidents that have a low probability of occurrence. Only as a result of a severe fire and/or a powerful collision, which are of extremely low probability, could a transportation package of the type used to transport radioactive material be damaged to the extent that there could be a release of radioactivity to the environment with significant consequences. In addition to calculating the radiological risks that would result from all reasonably conceivable accidents during transportation of radioactive materials, DOE assessed the consequences of maximum reasonably foreseeable accidents with a probability greater than 1×10^{-7} (1 chance in 10 million) per year. The latter consequences were determined for atmospheric conditions that would prevail during accidents. The analysis used the RISKIND computer code to estimate doses to individuals and populations (Yuan et al. 1995).

Radiological accident risk is expressed as additional LCFs, and nonradiological accident risk as additional immediate (traffic) fatalities. Incident-free risk is also expressed as additional LCFs.

In determining the transportation risks, per-shipment risk factors were calculated for the incident-free and accident conditions using the RADTRAN 5 computer program (SNL 2003) in conjunction with the Transportation Routing Analysis Geographic Information System (TRAGIS) computer program (Johnson and Michelhaugh 2003) to choose transportation routes in accordance with U.S. Department of Transportation (DOT) regulations. The TRAGIS program provides population estimates based on the 2000 census along the routes for determining the population radiological risk factors. The analysis approach and details on modeling and parameter selections are provided in Appendix D of this EIS.

Under the No Action Alternative, DOE would transport neptunium-237 from its storage location in FMF at INL to the REDC target fabrication facility at ORNL. Nonirradiated neptunium-237 targets would be transported from REDC to ATR at INL (and also to HFIR at ORNL, should it be required). Following irradiation in ATR (and HFIR), the targets would be returned to REDC for processing. The separated plutonium-238 products would be shipped to the Plutonium Facility at LANL for purification, pelletization, and encapsulation within strong cladding material. The encapsulated plutonium-238 would be shipped to the Assembly and Testing Facility at INL for RPS assembly and testing. The neptunium and plutonium materials would be transported between the sites using DOE Safe, Secure Trailers (SSTs), and the nonirradiated and irradiated fabricated targets would be transported using commercial trucks. It was assumed that HFIR would produce about 1 to 2 kilograms (2.2 to 4.4 pounds) of plutonium-238 per year. These assumptions are consistent with those used in the *NI PEIS* (DOE 2000f).

Under the No Action Alternative, 595 truck shipments of radioactive materials would be made between the sites involved. The total distance traveled on public roads would be 1.92 million kilometers (1.2 million miles).

Impacts of Incident-Free Transportation

The dose to transportation workers from all transportation activities under the No Action Alternative has been estimated to be 15 person-rem, and the dose to the public would be 22 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0.009 LCFs among transportation workers and 0.013 LCFs in the total affected population over the duration of transportation activities. LCFs associated with radiological releases were estimated by multiplying the occupational (worker) and public dose by 6.0×10^{-4} LCFs per person-rem of exposure.

Impacts of Transportation Accidents

As stated earlier, two sets of analyses were performed for the evaluation of transportation accident impacts: impacts of maximum reasonably foreseeable severe accidents and impacts of all conceivable accidents (total transportation accidents).

The maximum reasonably foreseeable offsite transportation accident under the No Action Alternative (probability of occurrence: more than 1 in 10 million per year) is a medium to high category impact with fire accident involving a shipment of irradiated neptunium targets to REDC at ORNL. The consequences of such an accident in terms of population dose in the rural, suburban, and urban zones are: 0.019, 0.43, and 3.0 person-rem, respectively. The likelihood of occurrence of such consequences per year is less than 1.4×10^{-5}, 3.6×10^{-6}, and 3.2×10^{-7} in rural, suburban, and urban zones, respectively. This accident could result in a dose of 0.008 rem to a hypothetical individual exposed to the accident plume for 2 hours at a distance of 100 meters (330 feet), with a corresponding LCF risk of 4.8×10^{-6}.

As described in Appendix D, Section D.7 of this EIS, estimates of the total transportation accident risks under this alternative are as follows: a radiological dose to the population of 0.0038 person-rem, resulting in 2.3×10^{-6} LCFs, and traffic accidents resulting in 0 (0.036) fatalities, based on 1.9 million kilometers (1.2 million miles) traveled.

4.1.9.4 Emergency Preparedness

Under the No Action Alternative—Transportation of radioactive materials would occur between INL, ORNL, and LANL. Radioactive waste shipments would occur to offsite waste management facilities under all alternatives.

This section addresses emergency management and response along transport routes and at the DOE sites. The emergency management and response infrastructure that supports current RPS production activities and that would support response to activities within INL boundaries is discussed in the emergency preparedness and security sections in Chapter 3 of this EIS.

State and local governments are responsible for emergency preparedness, management, and response programs. These programs must be capable of managing all hazards, ranging from natural disasters to hazardous material incidents, on a day-to-day basis. To maintain these programs, various State, Tribal, and local governments receive Federal funding. DOE, along with other Federal agencies (e.g., DOT, The U.S. Nuclear Regulatory Commission [NRC], Federal Emergency Management Agency, U.S. Department of Defense, and U.S. Environmental Protection Agency [EPA]), would provide support and assistance to State, Tribal, and local government agencies responsible for responding to a radioactive material incident (DOE 1996b).

Radioactive Material Transportation—Radioactive material shipments transported by truck carrier would be subject to the same potential problems as any other hazardous material shipment—severe weather, mechanical problems, derailments, and collisions. Radioactive material shipments, like other hazardous material shipments, have been involved in accidents or incidents. In most cases, no radioactive material was released into the environment. When releases have occurred, the material has been cleaned up, with no identifiable harm to the public or environment (DOE 1999d).

DOE fulfills its role and responsibilities as the Federal agency tasked with developing and maintaining the capability to safely transport radioactive materials, in part by setting overall program management responsibility and policy for transportation and emergency management and response; resolving policy questions; issuing guidance; providing information; and accomplishing oversight by including regulatory compliance requirements in its radioactive-material-related contracts and by monitoring the performance of those involved (DOE 1996b). In 2002, there were 5,028 radioactive material shipments (DOE 2003b). To date, no one has ever been killed or seriously injured in an accident involving radioactive materials as a result of the radioactive nature of the cargo (DOE 1999d).

States and tribes are responsible for notifying DOE of any conditions that could affect the safe, and secure transport of shipments through their jurisdictions. States coordinate with local jurisdictions on emergency planning and information. DOE provides technical advice and assistance to the shippers and affected government jurisdictions to ensure safe transportation (DOE 1996b).

Nonsecurity-Risk Radioactive Materials and Waste Shipments—During transport of the nonsecurity-risk radioactive materials and wastes, DOE and the commercial carrier are required to ensure that all activities conform to regulatory requirements. For shipments identified as "Highway Route Controlled Quantity," DOE requires the shipper, on behalf of DOE and/or the carrier, to provide DOE Headquarters National Transportation Program a shipment plan with routing identified 45 days in advance of the shipment. The carrier must provide a written route plan to the shipper and the driver prior to departure (DOE 1999d). DOE provides the governor or the governor's designee written notice in advance of unclassified spent nuclear fuel and high-level radioactive waste shipments within or through their state. DOE also notifies tribal governments of DOE shipments through their jurisdictions. This written notice includes the planned schedule(s), route, shipment description, and carrier's name and address (DOE 1999d).

Radioactive material shipments are tracked by either the commercial carrier or a satellite tracking system similar to DOE's original Transportation Tracking and Communications System (TRANSCOM). TRANSCOM2000 is an updated tracking system used to monitor the progress of various unclassified, high-visibility-shipments. It is available to more than 300 authorized DOE shipping and transportation clients, including state, local, and tribal governments. TRANSCOM2000 uses onboard satellite Global Positioning Systems to track truck and rail shipments from origin to destination. Shipment position and messaging data are made available over the TRANSCOM2000 Website in 4- to 7-minute intervals (TCC 2005).

If a situation arose (e.g., severe weather, mechanical difficulties, protesters, security threat, personnel illness or injury) that presented a hazard or threat to a highway shipment, DOE would have arranged through a memorandum of agreement for the commercial carrier to divert to any Federal installation (e.g., a DOE site or military base) and request "SAFE PARKING" at that facility until the situation is resolved. The receiving facility would assist in providing security and logistical support until the shipment was prepared to depart. The satellite tracking system would be used to coordinate "SAFE PARKING" requests (DOE 1996b).

Security-Risk Radioactive Material Shipments—In addition to the above requirements for nonsecurity-risk radioactive material shipments, security-risk radioactive materials would be shipped using SSTs. These are specially-designed, operated, and monitored vehicles that contain various security features not found in typical commercial trucks. Security-risk material shipments are tracked by TRANSCOM2000. Radioactive materials transported by SST would be subject to the same potential problems as any other hazardous material shipment that travels daily by these means, namely, severe weather, mechanical problems, and collisions (DOE 1996b).

First Responders—State, local, and tribal agencies, as well as commercial carriers, maintain various emergency response plans and procedures. During an accident, the personnel accompanying the shipment would be the immediate contact for information to the local emergency responders having jurisdiction and Incident Commander authority over the situation. Additionally, the hazardous material regulations (49 CFR 177.861) advise highway shippers, carriers, and emergency responders to contact DOE if assistance with radioactive materials is required. A DOE Radiological Assistance Program (RAP) team could respond to the scene if requested (DOE 1996b).

Primary responsibility for emergency response to a radioactive material incident resides with local authorities. Each corridor state or tribe is responsible for augmenting their existing emergency management and response plans and procedures with any shipment-specific information determined necessary (DOE 1996b).

First responders cordon off contaminated areas and initiate controls to minimize further release of contaminated or radioactive material. They also perform lifesaving duties, extinguish fires, clear unauthorized people from the immediate area, and control traffic in the event of an accident. Local responders usually contact state public health agencies. These agencies have trained personnel to conduct radiological tests at the site to determine if any radioactive material releases have occurred. Many local and state governments have emergency plans and training programs to prepare first responders for transportation accidents involving radioactive materials (DOE 1999d).

Incident Commanders have other sources of technical assistance available, such as the commercial carrier's technical experts (through a 24-hour contact number), the National Response Center, and the Chemical Transportation Emergency Center (CHEMTREC), which provides immediate response advice and information from the shipper on a 24-hour basis (DOE 1996b).

DOE maintains eight Regional Coordinating Offices across the country. Staffed 24 hours a day, 365 days a year, they are prepared to offer advice and assistance. They also ensure that appropriate state and tribal agencies are contacted and coordinate any necessary RAP team activities. These teams include nuclear engineers, health physicists, industrial hygienists, public affairs specialists, and other personnel who provide field monitoring, sampling, decontamination, communications, and other services as requested (DOE 1999d).

DOE offers training courses designed to teach basic emergency response procedures for dealing with radioactive materials. Assistance and emergency response training are also provided by the Federal Emergency Management Agency, DOT, NRC, and EPA. Assistance is also offered by the chemical industry through CHEMTREC. The National Response Center works closely with CHEMTREC on emergency calls and activates National Response Teams, if necessary. If commercial carriers are involved, the carrier of the cargo works with the appropriate Government agencies to address all cleanup issues, such as arranging for repackaging of the cargo, if necessary, and disposing of contaminated materials (DOE 1999d).

Assistance to States and Tribes—DOE is responsible for assisting state, local, and tribal officials in preparing for the safe shipment of radioactive materials through their communities and in responding to transportation incidents (DOE 2005c). The following assistance is provided:

- emergency planning and guidance,
- training material development and delivery,
- emergency drills and exercises,
- centralized emergency notification,

- support to emergency responders (radiological surveys, technical assistance, and public information), and
- post-incident assessment (along with other agencies).

Section 180(c) of the Nuclear Waste Policy Act, as amended, requires DOE to provide technical assistance and funds to states for training public safety officials of appropriate units of local government and American Indian tribes through whose jurisdiction the Secretary plans to transport spent nuclear fuel or high-level radioactive waste. The training is to cover procedures required for safe routine transportation of these materials, as well as procedures for dealing with emergency response situations (DOE 2004c). Funding for tribes is also made available through several other Federal agencies (i.e., Federal Emergency Management Agency, Homeland Security) and other organizations and programs (e.g., Comprehensive HAZMAT Emergency Response-Capability Assessment Program, First Responder Grant, Firefighters Grant Program) (DOE 2003b). As a means of assisting tribes in obtaining funding from appropriate sources to develop and sustain emergency preparedness/response and other programs, DOE prepared "Developing Grant Proposals: A Guide for Tribal Emergency Preparedness Coordinators." This document provides an exhaustive list of funding sources, along with detailed step-by-step guidance on the grant application process (DOE 2004b).

RAP is the primary DOE response group that would assist at a radioactive material incident. RAP is divided into eight geographical regions, each managed by a Regional Coordinating Office. Each region has one or more RAP response teams (DOE 2005d). The program assists state, tribal, local, and other Federal agencies in responding to radiological incidents. RAP provides a graded response based on accident severity (DOE 2003b). It provides resources (trained personnel and equipment) to evaluate, assess, advise, and assist in the mitigation of actual or perceived radiation hazards and risks to workers, the public, and the environment (DOE 2005d).

RAP teams are comprised of DOE and DOE contractor personnel specifically trained to perform radiological response activities as part of their formal employment or as part of the terms of the contract between their employer and DOE. A fully configured RAP team consists of a Team Leader, a Team Captain, four health physicists, survey/support personnel, and a Public Information Officer. A RAP team may deploy with two or more members, depending on the potential hazards, risks, or emergency scenario. The teams are equipped with personnel protective equipment, radiation monitoring instruments, air sampling equipment, communications equipment, and other emergency response devices (DOE 2005d).

Liability—The required amount of liability coverage for carriers of radioactive materials varies according to the mode of transport (road, rail, waterway, or air) and the type and quantity of radioactive material being shipped. If the damages from a transportation-related accident exceed the amount of the carrier's private insurance coverage, umbrella coverage is provided under the Price-Anderson Act (DOE 1999d).

Coverage is also provided for damages created as a result of terrorism, sabotage, and other illegal acts occurring during transport. In addition, the 1988 amendments clarified coverage for the costs of precautionary evacuation initiated by state, tribal, or local officials. If damage claims from an accident exceed the maximum limits of protection, Congress would review the incident and enact legislation to provide full and prompt public compensation (DOE 1999d).

4.1.10 Environmental Justice

No disproportionately high and adverse environmental impacts on minority and low-income populations would occur under the No Action Alternative. This conclusion is a result of investigations in this EIS that determined there would be no significant impacts on human health or ecological, cultural, socioeconomic, or other resource areas described in other subsections of Section 4.1.

Under the No Action Alternative, all RPS nuclear production operations would be conducted in existing facilities at ATR and MFC at INL, REDC and HFIR at ORNL, and the Plutonium Facility at LANL, and no new facilities would be constructed. As discussed in Section 4.1.9.1, radiological and hazardous chemical risks to the public resulting from normal operations would be small. Routine normal operations at these existing facilities are not expected to cause fatalities or illness among the general population, including minority and low-income populations living within the potentially affected area.

Annual radiological risks to the offsite population that could result from accidents at these existing facilities are estimated to be less than 0.0045 LCFs (see Section 4.1.9.2). Hence, the annual risks of an LCF in the entire offsite population resulting from an accident under the No Action Alternative would be less than 1 in 222.

In summary, implementation of the No Action Alternative would pose no disproportionately high and adverse health or safety risks to minority and low-income populations living in the potentially affected area surrounding RPS nuclear production facilities at MFC.

Subsistence Consumption of Fish, Wildlife, and Game

Section 4-4 of Executive Order 12898 directs Federal agencies "whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence and that Federal governments communicate to the public the risks of these consumption patterns." DOE has considered whether there are any means for minority and low-income populations to be disproportionately affected by examining health studies and levels of contaminants in fish, crops, livestock, and game animals on or near ORNL, LANL, and INL (DOE 1999a, 2001, 2002e).

As discussed in this section, selection of the No Action Alternative would pose no disproportionately high and adverse human health impacts on minority or low-income populations in the regions around ORNL, LANL, and INL. Moreover, the impact analyses conducted for this EIS (see Section 4.1.6) indicate that native plants and wildlife in the ROIs would not be harmed by RPS nuclear production operations at these sites. Consequently, no disproportionately high and adverse human health impacts are expected in minority or low-income populations as a result of subsistence consumption of fish, wildlife, native plants, or crops.

4.1.11 Waste Management and Pollution Prevention

4.1.11.1 Waste Management

The impacts on the INL, ORNL, and LANL waste management systems in terms of managing the additional waste generated under the No Action Alternative are discussed in this section. This analysis is consistent with policy and DOE Order 435.1 that DOE radioactive waste shall be treated, stored, and, in the case of low-level radioactive waste, disposed of at the site where the waste is generated, if practical, or at another DOE facility. However, if DOE determines that use of the INL, ORNL, or LANL waste management infrastructure or other DOE sites is not practical or cost-effective, DOE may issue an exemption under DOE Order 435.1 for the use of non-DOE facilities (i.e., commercial facilities) to store, treat, and dispose of such waste. Radiological and chemical impacts on workers and the public from waste management activities are included in the public and occupational health and safety impacts that are provided in Section 4.1.9.

Under the No Action Alternative, no waste is expected to be generated during storage of neptunium-237 at INL. Therefore, incremental impacts on the environment would be negligible (DOE 2000f). Only very small amounts of additional waste would be generated as a result of irradiating neptunium-237 targets in ATR and HFIR (should it be required) because these reactors are already in continuous operation for other purposes. The incremental amount of this waste is anticipated to be very small (about 1 cubic meter [1.3 cubic yards] per year of solid low-level radioactive waste), and, therefore, no impacts on the waste management systems at INL or ORNL are anticipated (DOE 2000f).

The expected generation rates of waste at ORNL that would be associated with the operation of REDC to fabricate and process the neptunium-237 targets are compared with ORNL's treatment, storage, and disposal capacities in **Table 4–9**. Target fabrication and processing in REDC would generate a total of 385 cubic meters (504 cubic yards) of transuranic waste over the 35-year operational period. The waste would be vitrified into a glass matrix at a glass melter installed within REDC. The resulting glass matrix would be stored onsite pending shipment to the Waste Isolation Pilot Plant (WIPP). This additional waste would represent approximately 18 percent of the available 2,169-cubic-meter (2,837-cubic-yard) storage capacity in facilities 7572, 7574, 7826, 7878, 7879, and 7883. The impacts of managing the additional quantities of this waste at ORNL would be minimal (DOE 2000f).

Table 4–9 Incremental Waste Management Impacts of Operating the Radiochemical Engineering Development Center at Oak Ridge National Laboratory Under the No Action Alternative

Waste Type [a]	*Estimated Annual Waste Generation (cubic meters)*	*Estimated Additional Waste Generation as a Percent of* [b]		
		Onsite Treatment Capacity	*Onsite Storage Capacity*	*Onsite Disposal Capacity*
Transuranic [c]	11	(c)	18	Not applicable [d]
Liquid low-level radioactive	25	0.13	24 [e]	Not applicable [h]
Solid low-level radioactive	35	Not applicable [f]	2.6 [g]	Not applicable [h]
Solid mixed low-level radioactive	< 5	< 2.2 [i]	< 0.57 [j]	Not applicable [h]
Hazardous	6,500 kilograms	Not applicable [k]	Not applicable [k]	Not applicable [k]
Nonhazardous process wastewater	23	0.0017	Not applicable [l]	Not applicable [l]
Nonhazardous sanitary wastewater	2,832	0.0068	Not applicable	Not applicable
Nonhazardous solid	148	Not applicable [m]	Not applicable [m]	0.42

a See definitions in Section B.12.1.
b The estimated additional amounts of waste generated annually are compared with the annual site treatment capacities. The estimated total amounts of additional waste generated over the assumed 35-year operational period are compared with the site storage and disposal capacities.
c Refer to Section 3.4.11 for a discussion on waste classification and treatment.
d This waste would be stored onsite pending availability of a suitable repository. It is assumed this waste would be remotely handled.
e Liquid low-level radioactive waste is processed through an evaporator for volume reduction. The evaporator bottoms are stored as a concentrated solution.
f The solid low-level radioactive waste would not be treated onsite.
g Refer to the text for a discussion of potential limitations of the onsite storage capacity for solid low-level radioactive waste and the probable solution.
h It is anticipated that solid low-level radioactive waste and solid mixed low-level radioactive waste would be disposed of at an offsite facility.
i In the short-term, the Toxic Substances Control Act Incinerator would be used for the treatment of solid mixed low-level radioactive waste. If this facility is shut down, the site's management and integration contractor would identify other options for treatment of this waste.
j Refer to the text for a discussion of potential limitations of the onsite storage capacity for solid mixed low-level radioactive waste and the probable solution.
k Although there is some treatment and storage capacity for hazardous waste, this waste would be shipped offsite to permitted commercial facilities.
l The nonhazardous process wastewater would be discharged to a permitted outfall or otherwise disposed of offsite after onsite treatment.
m Solid nonhazardous waste would be taken to the Oak Ridge Y-12 landfill for disposal.

Note: To convert from cubic meters to cubic yards, multiply by 1.3079; from kilograms to pounds, by 2.2046.
Source: DOE 2000f.

Low-level radioactive waste at ORNL would be treated, packaged, certified, and accumulated before transfer for additional treatment and disposal at on- and offsite facilities. Annual liquid low-level radioactive waste generation (including mixed low-level radioactive waste—see Table 4–9) that would be associated with target fabrication and processing in REDC is estimated to be 0.13 percent of the 19,908-cubic-meter-per-year (26,040-cubic-yard-per-year) site treatment capacity. If all the liquid low-level radioactive waste generated over the 35-year operational period were stored onsite, the amount would represent 24 percent of the 3,646-cubic-meter (4,769-cubic-yard) storage capacity at ORNL (DOE 2000f). Storage capacity would not be exceeded, because liquid low-level radioactive waste is continually treated by evaporation, which significantly reduces the volume.

Solid low-level radioactive waste would not be treated onsite. If all the solid low-level radioactive waste generated over the 35-year operational period were stored onsite, the amount would represent 2.6 percent of the 47,000-cubic-meter (61,500-cubic-yard) storage capacity at ORNL. If account is taken of the existing inventory of solid low-level radioactive waste (41,000 cubic meters [53,600 cubic yards]) and of its present generation rate (7,000 cubic meters [9,160 cubic yards] per year), sufficient storage capacity probably would not be available. However, this should be considered only an interim situation. Arrangements are being made that would allow the solid low-level radioactive waste to be treated and disposed of offsite at another DOE site or at a commercial facility, thereby eliminating any onsite storage problems, including the storage capacity limitations at ORNL. Management of the additional low-level radioactive waste from 35 years of operating REDC to fabricate and process neptunium-237 targets would not have a major impact on ORNL's ability to manage low-level radioactive waste (DOE 2000f).

Canisters used to transport neptunium-237 to ORNL would constitute a very small amount of solid low-level radioactive waste—less than 10 cubic meters (13.1 cubic yards) over the 35-year operational period, even if no credit is taken for volume reduction by compaction (DOE 2000f). Annual generation of this waste would fall within the range of accuracy of the generation rate of solid low-level radioactive waste provided in Table 4–9, and its management is not addressed separately.

Mixed low-level radioactive waste associated with target fabrication and processing at ORNL would be stabilized, packaged, and stored onsite for treatment and disposal in a manner consistent with the site treatment plan. Liquid mixed low-level radioactive waste is reported as low-level radioactive waste; generation and management of this waste are covered under the low-level radioactive waste discussion above. Solid mixed low-level radioactive waste generation is estimated to be less than 2.2 percent of the 227-cubic- meter-per-year (297-cubic-yard-per-year) site treatment capacity. If all the solid mixed low-level radioactive waste generated over the 35-year operational period were stored onsite, the amount would represent less than 0.57 percent of the 30,780-cubic-meter (40,260-cubic-yard) storage capacity at ORNL. However, if account is taken of the existing inventory of solid mixed low-level radioactive waste (24,964 cubic meters [32,700 cubic yards]) and of its present generation rate (801 cubic meters [1,050 cubic yards] per year), part or all of the storage capacity may not be available. As is the case for the solid low-level radioactive waste, solid mixed low-level radioactive waste could be disposed of offsite at another DOE site or at a commercial facility, thereby eliminating any onsite storage problems, including the storage capacity limitations at ORNL. Managing the small additional quantities of mixed low-level radioactive waste that would be generated at ORNL would not impact ORNL's management of this type of waste (DOE 2000f).

At ORNL, hazardous waste associated with the fabrication and processing of neptunium-237 targets at REDC would be packaged in DOT-approved containers and shipped offsite to permitted commercial recycling, treatment, and disposal facilities. The additional waste load generated during the operational period would have only a minimal impact on ORNL's management of hazardous waste (DOE 2000f).

Nonhazardous solid waste associated with target fabrication and processing in REDC would be packaged in conformance with standard industrial practices and disposed of in the onsite landfills. If all the nonhazardous solid waste generated over the 35-year operational period were disposed of in Industrial Landfills V and VI, only 0.42 percent of the 1,219,000-cubic-meter (1,594,000-cubic-yard) total capacity of these landfills would be needed. Nonhazardous sanitary wastewater from REDC operations would be discharged to the sanitary wastewater treatment facility. Nonhazardous process wastewater would be processed, as necessary, in the wastewater treatment facilities before discharge to an outfall or other offsite disposal facility. The additional solid and liquid waste loads would have only a minimal impact on nonhazardous waste management at ORNL (DOE 2000a).

The generation rates of waste at ORNL associated with this alternative (see Table 4–9) can be compared with the current waste generation rates at the site, provided in Table 3–52. The waste generation rates associated with plutonium-238 production would be much smaller than the current waste generation rates at the site (DOE 2000f).

The expected generation rates of waste at LANL associated with operation of the Plutonium Facility to purify, pelletize, and encapsulate the plutonium-238 are compared with LANL's sitewide 2003 waste generation rate in **Table 4–10**. Waste generation rates for the Plutonium Facility are less than 3 percent of the annual sitewide waste generation rates and are not expected to adversely affect the LANL waste management infrastructure.

Table 4–10 Incremental Waste Management Impacts of Operating the Plutonium Facility at Los Alamos National Laboratory Under the No Action Alternative

Waste Type	*Annual Generation Rate (cubic meters, except as noted)*	*Annual LANL 2003 Sitewide Generation Rate (cubic meters, except as noted)*	*Percent of Sitewide Generation*
Transuranic	13	560	2.3
Low-level radioactive	150	5,625	2.7
Mixed low-level radioactive	0.34	36	0.9
Hazardous [a]	< 1 kilogram	689,000 kilograms	Less than 0.0001 percent

LANL = Los Alamos National Laboratory.

[a] The amount of hazardous waste generated at the LANL Plutonium Facility at TA-55 for the production of heat sources is very small. The hazardous waste generated from TA-55 overall operations is insignificant compared to other facilities at LANL.

Note: To convert from cubic meters to cubic yards, multiply by 1.3079; from kilograms to pounds, by 2.2046.

Source: LANL 2004b.

4.1.11.2 Waste Minimization and Pollution Prevention

As previously described, this alternative would result in continued waste generation. Waste generation activities would be scrutinized to identify opportunities for waste minimization. Wastes would be minimized where feasible by: (1) recycling; (2) processing waste to reduce its quantity, volume, or toxicity; (3) substituting materials or processes that generate hazardous wastes with others that result in less hazardous wastes; and (4) segregating waste materials to prevent contamination of nonradioactive and nonhazardous materials.

4.1.12 Environmental Restoration Program

The cleanup of past releases of contaminants at INL, ORNL, and LANL is occurring under applicable Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulations and consent agreements. Because current activities would continue in existing facilities under the No Action Alternative, no impacts on the Environmental Restoration Program are anticipated.

4.2 Consolidation Alternative

A detailed description of the Consolidation Alternative is presented in Section 2.2.2 of this EIS.

Information on impacts of continued operation of the FMF storage facility and ATR at INL was compiled from the *NI PEIS* (DOE 2000f). The impacts of construction and operation of the new RPS nuclear production facilities at MFC at INL are largely based on the *Consolidation EIS* information document (INL 2005c). The impacts of Assembly and Testing Facility operation at INL are based on the *FONSI and Mound EA* (DOE 2002c). Under this alternative, the Plutonium Facility at LANL would continue to support RPS nuclear production operations until 2011 when the new Plutonium-238 Facility becomes operational. The impacts from purification, pelletization, and encapsulation operations would be the same as described under the No Action Alternative. After 2011, these operations would be conducted at the new Plutonium-238 Facility at INL.

4.2.1 Land Resources

4.2.1.1 Land Use

Construction and Operations Impacts—Under the Consolidation Alternative, FMF at MFC, ATR, and the Assembly and Testing Facility at INL would continue to be used. There would be no change or effect on land use at INL from the continued use of these facilities because no additional land would be disturbed, and the use of existing facilities would be compatible with their present missions (DOE 2000f).

Total land disturbance during construction of the new Plutonium-238 Facility at MFC, its associated Support Building, and the Radiological Welding Laboratory (an addition to existing to Building 772 at MFC) would involve approximately 24 hectares (60 acres). Permanent disturbance, consisting of land used for buildings and parking lots, would impact approximately 12 hectares (30 acres). The remaining 12 hectares (30 acres) would be used for temporary construction laydown areas, trailers, and parking (INL 2005c). All of the new facilities would be located on previously disturbed land within the MFC Property Protected Area, and would be compatible with existing land use practices.

As part of the Consolidation Alternative, DOE would construct a paved, nonpublic service road from MFC to ATR for tractor/trailer transfers of radioactive materials. Figure 2-12 shows three potential routes for the new road, each of which would be located wholly on DOE INL land. The northern most route would extend westward from MFC for approximately 22 kilometers (14 miles) and generally follows the existing unimproved T-3 Road, where it would then connect with another existing gravel road near the Old Dairy Farm Project. This gravel road would be followed for approximately another 2.4 kilometers (1.5 miles) to its intersection with existing improved roads accessing the RTC. The entire route following T-3 Road and the dairy gravel road, 24 kilometers (15 miles) long, would be improved and paved with asphalt. Total land disturbance during construction of this new road would involve approximately 51 hectares (125 acres). Permanent disturbance, consisting of the land used from the pavement width and granular shoulders on either side, would impact approximately 36 hectares (90 acres) (INL 2005c).

The T-24 Road is an alternative route for the proposed new road between MFC and RTC and is located south of the T-3 Road. Approximately 16 kilometers (10 miles) would need to be paved from MFC until the road reaches the Critical Infrastructure Test Range Complex (CITRC) (formerly the Power Burst Facility) and connects to internal roads leading to RTC (INL 2005c). Total land disturbance during construction of this route would involve approximately 34 hectares (85 acres), with permanent disturbance impacting approximately 24 hectares (60 acres).

The East Power Line Road is another possible route that could lead from MFC to RTC. The East Power Line Road is currently maintained to a higher level than the other two jeep trails because of ongoing activities related to power line maintenance. Approximately 19 kilometers (12 miles) would need to be paved before the new road connects to internal INL paved roads at CITRC (INL 2005c). Total land disturbance during construction of this route would involve approximately 40 hectares (100 acres), with permanent disturbance impacting approximately 28 hectares (70 acres).

Impacts on land use along each of the proposed corridors would occur within the INL Central Core Area and would be compatible with associated land use practices. Impacts on previously undisturbed land could occur due to widening of the existing roadbed and use of heavy equipment, as well as if the new road does not completely follow the existing unimproved roads.

4.2.1.2 Visual Environment

Construction and Operations Impacts—Under the Consolidation Alternative, FMF, ATR, and the Assembly and Testing Facility would continue to be used. There would be no impact on visual resources from the continued use of these facilities since the current Visual Resource Management Class IV rating would not change.

Impacts on visual resources resulting from construction of consolidated RPS production facilities at MFC would be temporary in nature and could include increased levels of dust and human activity. Once completed, the general appearance of the one- to two-story facilities would be consistent with the other buildings located in MFC. Although these new facilities would add to the overall development of MFC and would likely be visible from Idaho State Route 20, they would not alter the industrial nature of the area. Accordingly, the current Class IV Visual Resource Contrast rating for MFC would not change.

Impacts on visual resources resulting from construction of the new road connecting MFC and ATR would include temporary increased levels of dust and human activity. In addition, completion and operation of the new road would alter the visual environment and likely change the Visual Resource Contrast ratings at undeveloped points along this corridor from Class II and Class III to Class III and Class IV.

4.2.2 Site Infrastructure

Construction Impacts—The projected annualized demands on site utility infrastructure resources associated with site construction under the Consolidation Alternative are presented in **Table 4–11**. Resources would be consumed in the construction of the new Plutonium-238 Facility at MFC, its associated Support Building, and the Radiological Welding Laboratory (an addition to existing Building 772 at MFC). A new road would be constructed to connect MFC and RTC.

Electric power needed to operate portable construction and supporting equipment would be supplied by portable diesel-fired generators. Therefore, there would be no electrical energy consumption directly associated with construction. A variety of heavy equipment, motor vehicles, and trucks would be deployed in both new facility and road construction, which would consume diesel fuel and gasoline. Propane-fired equipment would also be used. Liquid fuels would be brought to the site as needed from offsite sources and, therefore, would not be limited resources. Water requirements would be driven primarily by the need to provide dust control and aid soil compaction at the construction sites, and possibly for equipment washdown. Water would not be required for concrete mixing, as ready-mix concrete would be procured from offsite sources (INL 2005c). Portable sanitary facilities would be provided to meet the workday potable and sanitary needs of construction personnel on the site, which would constitute a relatively small percentage of the total water demand. It is expected that water would be trucked to the point of use as needed.

Over the 2-year construction period, total liquid fuel consumption is estimated to be 750,000 liters (198,000 gallons); including 204,000 liters (54,000 gallons) of diesel fuel; 397,000 liters (105,000 gallons) of gasoline; and 148,000 liters (39,000 gallons) of propane. Total water consumption is estimated to be 1,640,000 liters (432,000 gallons). The existing INL infrastructure would easily be capable of supporting the requirements for new facility construction without exceeding site capacities, resulting in negligible impact onsite utility infrastructure.

Table 4–11 Annual Utility Infrastructure Requirements for New Construction Under the Consolidation Alternative

Resource	Available Site Capacity [a]	INL [b]			Percent of Available Site Capacity
		New Road	New Facilities at MFC	Total	
Transportation					
Roads (kilometers)	Not applicable	24	0	22	Not applicable
Electricity					
Energy (megawatt-hours per year)	325,161	0	0	0	0
Peak load (megawatts)	19	0	0	0	0
Fuel					
Diesel fuel (liters per year)	Not limited [c]	(d)	(d)	103,000	Not applicable
Gasoline (liters per year)	Not limited [c]	(d)	(d)	199,000	Not applicable
Propane (liters per year)	Not limited [c]	(d)	(d)	74,000	Not applicable
Water (million liters per year)	38,800	(d)	(d)	0.82	0.002

INL = Idaho National Laboratory, MFC = Materials and Fuels Complex.

[a] Capacity minus the current site requirements, a calculation based on the data provided in Table 3–2 of this *Consolidation EIS*.

[b] Reflects additional demand in excess of existing MFC facilities proposed for use under this alternative. Includes construction of the road along the longest (northern most) route.

[c] Capacity is limited only by the ability to ship resource to the site.

[d] Projected consumption of liquid fuels and water is not split between new road and new building construction.

Note: To convert from kilometers to miles, multiply by 0.62137; from liters to gallons, by 0.26418.

Sources: Table 3–2 of this *Consolidation EIS,* INL 2005c, DOE 2002c.

Operations Impacts—The projected annualized demands onsite utility infrastructure resources associated with operations under the Consolidation Alternative are presented in **Table 4–12**. It is projected that existing INL and MFC infrastructure resources would be adequate to support proposed mission activities over 35 years.

As with the No Action Alternative, no incremental infrastructure usage would be associated with irradiation of neptunium-237 targets in ATR under the Consolidation Alternative because this reactor is already in continuous operation for other purposes (DOE 2000f). Similarly, storage of neptunium-237 targets in the existing FMF would have a negligible incremental impact on infrastructure demands. Operation of the new Plutonium-238 Facility at MFC, Support Building, and Radiological Welding Laboratory would have a minor incremental impact on utility infrastructure resources, as would RPS assembly and testing in the Assembly and Testing Facility.

The increased electric power load of the new facilities would be accommodated by a new substation equipped with two 2-megavolt-amphere-capacity (equivalent to approximately 3.2 megawatts) transformers. Additional fuel oil would be consumed by an existing heat plant at MFC to provide steam heat for the new facilities. Diesel fuel and gasoline would be consumed primarily by motor vehicles, including maintenance, delivery, and service trucks. This includes trucks used to transport neptunium-237 targets and irradiated targets between MFC and the RTC (INL 2005c). Emergency generators would also consume diesel fuel on an as-needed basis. Liquid fuels would be brought to the site as needed from offsite sources and, therefore, would not be limited resources. Water to meet the process, cooling, potable, and sanitary needs of the mission facilities would be supplied via the existing MFC water supply and distribution system.

Table 4–12 Annual Infrastructure Requirements for Facility Operations Under the Consolidation Alternative

Resource	Available Site Capacity [a]	MFC at INL [b]			Percent of Available Site Capacity
		New Facilities	SSPSF [c]	Total	
Electricity					
Energy (megawatt-hours per year)	325,161	8,600	2,039	10,639	3.3
Peak load (megawatts)	19	1.2 [d]	0.30 [d]	1.5	7.9
Fuel					
Fuel oil (liters per year)	Not limited [e]	800,000 [f]	189,000	989,000	Not applicable
Diesel fuel (liters per year)	Not limited [e]	87,000	0	87,000	Not applicable
Gasoline (liters per year)	Not limited [e]	16,300	0	16,300	Not applicable
Propane (liters per year)	Not limited [e]	0	0	0	Not applicable
Water (million liters per year)	38,800	47	28	75	0.19

MFC = Materials and Fuels Complex, INL = Idaho National Laboratory, SSPSF = Space and Security Power Systems Facility.

[a] Capacity minus the current site requirements, a calculation based on the data provided in Table 3–2 of this *Consolidation EIS*.
[b] Reflects additional demand in excess of existing MFC facilities proposed for use under this alternative.
[c] Also known as the Assembly and Testing Facility.
[d] Peak load estimated from average electrical energy usage, assuming peak load is 120 percent of average demand.
[e] Capacity is limited only by the ability to ship resource to the site.
[f] Fuel oil consumption estimated from increase in heating demand to accommodate floor area of new facilities.

Note: To convert from liters to gallons, multiply by 0.26418.
Source: INL 2005c.

4.2.3 Geology and Soils

Construction Impacts—Impacts on geology and soils under the Consolidation Alternative would generally be directly proportional to the total area of land disturbed by site grading and grubbing, soil compaction work, and the depth of construction associated with the new facilities. Consumption of geologic resources, including rock, mineral, and soil resources, to support new facility and road construction would constitute an indirect impact on geologic and soil resources.

New facility construction under this alternative would disturb about 24 hectares (60 acres) of land, while construction of the new road would disturb up to an additional 51 hectares (125 acres). For new facility construction, the area of disturbance includes temporary disturbance for construction laydown areas, construction parking, and temporary access roads. It also includes disturbance involved with trenching and excavation work necessary to install piping, utilities, and other conveyances between buildings and other facilities. Much of the area to be disturbed by construction of the new Plutonium-238 Facility at MFC, Support Building, and Radiological Welding Laboratory has been lightly disturbed previously, while the right-of-way for construction of the new road would follow existing unimproved roads to the extent possible (INL 2005c). Surface soils and unconsolidated sediments exposed in excavations would be subject to wind and water erosion if left exposed over an extended period of time. Adherence to standard best management practices for soil erosion and sediment control, including watering, during construction would serve to minimize soil erosion and loss. After construction, temporarily disturbed areas would be stabilized and/or revegetated and would not be subject to long-term soil erosion.

For construction of the basement level production wing of the new Plutonium-238 Facility at MFC, excavation depths of up to 4.6 meters (15 feet) may be necessary. Because of the presence of basalt outcrops in the MFC area and the general shallow depth to bedrock, rock excavation and/or blasting could be necessary. However, the site for construction of the Plutonium-238 Facility at MFC that is directly south of the Assembly and Testing Facility was selected to minimize rock removal for basement excavation and trenching for utility lines (INL 2005c). A site survey and foundation study would be conducted as necessary to confirm site geologic characteristics for facility engineering purposes.

New facility and road construction would require modest volumes of geologic resources. In addition to concrete (produced from cement, sand, and gravel), additional geologic resources in the form of borrow materials would be required for site grading, backfilling, and other construction-related uses as shown in **Table 4–13**. Total borrow material demand is estimated at 255,000 cubic meters (334,000 cubic yards). Project planning calls for ready-mix concrete and asphalt (comprised of bitumen and aggregate) to be procured from offsite resources, with aggregate (sand and gravel, crushed stone) and fill (soil and sediment) obtained from onsite quarries and borrow areas, including rye grass flats, Spreading Areas A, and the Water Reactor Research Test Facility (DOE 1997a). Construction activities are not expected to deplete available deposits or stockpiles of these materials, as they are widely available in the region. Offsite commercial quarries could supplement onsite sources if needed.

Table 4–13 Geologic and Soil Resource Requirements for New Construction Under the Consolidation Alternative

Geologic Resource (cubic meters)	*MFC at INL*		
	New Road [a]	*New Facilities*	*Total*
Construction Materials			
Concrete	0	31,600	31,600
Asphalt	20,700	400	21,100
Borrow Materials			
Aggregate	91,900	7,300	99,200
Fill (soil)	73,500	82,300	155,800

MFC = Materials and Fuels Complex, INL = Idaho National Laboratory.
[a] For longest route.
Note: To convert from cubic meters to cubic yards, multiply by 1.3079.
Source: INL 2005c.

As discussed in Section 3.2.3.1, the Eastern Snake River Plain on which INL is situated is a region of relatively low seismicity, although higher rates of seismic activity are indicated for regions in the surrounding Basin and Range Physiographic Province. Ground shaking of MMI VI (see Table B–7) has been reported on the site in the recent past associated with a major earthquake located in the Borah Peak Range northwest of INL. Otherwise, relatively few and minor earthquakes have occurred in the area surrounding INL. MMI VI shaking typically causes only slight damage to structures, while MMI VII activity is expected to primarily affect the integrity of inadequately designed or nonreinforced structures, but damage to properly or specially-designed or upgraded facilities is not expected. Nevertheless, two fault segments in the vicinity of INL are considered potentially active. The closest fault (the Howe Segment of the Lemhi Fault) is located 31 kilometers (19 miles) northwest of MFC. The likelihood of future volcanic activity along the Axial Volcanic Zone during the 35-year project period is considered low. The potential for nontectonic events to affect MFC facilities is also low.

All new facilities would be designed, constructed, and operated in compliance with applicable DOE Orders, requirements, and governing standards that have been established to protect public and worker health and the environment. DOE Order 420.1A requires that nuclear and nonnuclear facilities be designed, constructed, and operated so that the public, workers, and environment are protected from the adverse impacts of natural phenomena hazards, including earthquakes. The Order stipulates natural phenomena hazards mitigation requirements for DOE facilities and specifically provides for reevaluation and upgrade of existing DOE facilities when there is a significant degradation in the safety basis for the facility. DOE Standard 1020-2002 implements DOE Order 420.1A and provides criteria for design of new structures, systems, and components and for evaluation, modification, or upgrade of existing structures, systems, and components so that DOE facilities safely withstand the effects of natural phenomena hazards, such as earthquakes. The criteria specifically reflect adoption of the seismic design and construction provisions of the *International Building Code* for DOE Performance Category 1 and 2 facilities. An analysis of potential effects of a beyond-design-basis earthquake on human health and the environment is provided in Section 4.2.9.2.

Operations Impacts—Operations of the new facilities at MFC are expected to result in minimal impacts on geologic and soil resources at INL, and the new facilities would not preclude use of rare or otherwise valuable geologic or soil resources. Accordingly, neptunium-237 storage in FMF and operation of ATR would have minimal operational impact on geology and soils (see Section 4.1.3).

As discussed above, the proposed new facilities and uses at MFC would be evaluated, designed, and constructed in accordance with DOE Order 420.1A and sited to minimize the risk from geologic hazards, including earthquakes. Further, seismic conditions present a low risk to properly designed facilities such as the existing MFC facilities proposed for use under this alternative. Thus, site geologic conditions would not likely affect the facilities during the 35-year project period.

4.2.4 Water Resources

4.2.4.1 Surface Water

Construction Impacts—*Surface water* would not be used to support construction of new facilities or facility modifications under the Consolidation Alternative. Groundwater is the source of water at MFC and across INL.

Construction personnel would generate sanitary wastewater. As project plans call for use of portable sanitary facilities during new facility construction, there would be no onsite discharge of sanitary wastewater and no impact on surface water quality. Waste generation and management activities are detailed in Section 4.2.11.1.

The potential for stormwater runoff from construction areas to impact downstream surface water quality is small. Surface drainages in the vicinity of MFC are poorly defined and ephemeral, while infiltration to the subsurface is relatively rapid on unconsolidated sediment. Further, the closest major surface water drainage is more than 20 kilometers (12 miles) west of MFC. Any effects on runoff quality would likely be very localized and of short duration. Appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulching disturbed areas, etc.) and spill prevention practices would be employed during construction to minimize suspended sediment and material transport and potential water quality impacts. Specifically, in accordance with INL's General Permit for Storm Water Discharges from Construction Sites, the *INEEL Storm Water Pollution Prevention Plan for Construction Activities* provides for measures and controls to prevent pollution of stormwater from construction activities at INL (see Section 3.2.4.1). MFC is not located in an area prone to flooding, as the complex is 82 meters (270 feet) feet higher and approximately 18 kilometers (11 miles) away from the nearest potential source of river flooding (ANL 2003).

Figure 2–12 shows three potential routes for the new road. DOE regulations (10 CFR 1022) for implementation of Executive Order 11988, Floodplain Management require that a floodplain assessment be prepared for any proposed action located in a base (100-year) or critical action (500-year) floodplain. New construction on the southern two routes would not cross major stream drainages and would not be in the 100 or 500-year floodplains, and therefore would not impact surface water resources. The northernmost route that parallels the T-3 Road (old stagecoach trail) could affect the Big Lost River floodplain. Appendix F of this EIS contains a Preliminary Floodplain/Wetland Assessment.

Operations Impacts—No surface water would be used to support facility activities, and there would be no direct discharge of sanitary or industrial effluent to surface waters from facility operations. All wastewater would be collected and conveyed to existing wastewater treatment facilities. Nonhazardous wastewater (primarily sanitary) would comprise the majority of the liquid effluent generated by the proposed facilities as presented in **Table 4–14**.

Table 4–14 Annual Water Use and Wastewater Generation Associated with Operating Facilities Under the Consolidation Alternative

Indicator (million liters per year)	*MFC at INL*		
	New Facilities	*SSPSF* [a]	*Total*
Water use	47	28	75
Process wastewater generation	0.023	none	0.023
Sanitary wastewater generation	47 [b]	28 [b]	75

MFC = Materials and Fuels Complex, INL = Idaho National Laboratory, SSPSF = Space and Security Power Systems Facility.
[a] Also known as the Assembly and Testing Facility.
[b] Assumes all water used becomes sanitary wastewater.
Note: To convert from liters to gallons, multiply by 0.26418.
Sources: DOE 2002c, INL 2005c.

Specifically, sanitary wastewater would be generated from operations personnel use of lavatory, shower, and break-room facilities and from miscellaneous physical plant (e.g., HVAC) uses. Sanitary wastewater would be disposed of in the MFC sanitary lagoons. An estimated 23,000 liters (6,100 gallons) per year of process wastewater would also be generated associated with target processing in the Plutonium-238 Facility at MFC. This wastewater would be collected, processed, and eventually shipped by a specially equipped tanker trailer truck to the Radioactive Liquid Waste Treatment Facility for final disposal. There would be no radiological liquid effluent discharge to the environment under normal operations. Waste generation and management activities are detailed in Section 4.2.11.1.

The design and operation of new facility areas would incorporate appropriate stormwater management controls to safely collect and convey stormwater from facilities while minimizing washout and soil erosion. Also, in accordance with INL's Storm Water Multi-Sector General Permit for stormwater discharges associated with industrial activity, the *INEEL Storm Water Pollution Prevention Plan for Industrial Activities* provides for baseline and tailored controls and measures to prevent pollution of stormwater from industrial activities at INL (see Section 3.2.4.1). Overall, no measurable impacts on surface water resources are expected as a result of facility operations at MFC under this alternative.

4.2.4.2 Groundwater

Construction Impacts—Water would be required during construction for uses such as dust control and soil compaction, equipment washing and flushing activities, and to meet the potable and sanitary needs of construction employees. Water use by construction personnel would be greatly reduced over that normally required by the use of portable toilets. As outlined in Section 4.2.2, water would not be required for mixing concrete, as ready-mix concrete would be brought from offsite. As a result, it is estimated that new facility and road construction activities would require about 1,640,000 liters (432,000 gallons) of groundwater during the 2-year construction period (see Section 4.2.2). It is anticipated water would be trucked to the point of use. The relatively small volume of groundwater required during the period of construction compared to site availability and historic usage indicates that construction withdrawals should not have an additional impact on regional groundwater levels or availability. As the depth of groundwater is some 183 meters (600 feet), construction dewatering would not be required for construction of the below-grade portions of the Plutonium-238 Facility at

MFC. Facility construction would be unlikely to have any direct impact on groundwater hydrology or contaminant plumes under this alternative.

There would be no onsite discharge of wastewater to the surface or subsurface during construction, and appropriate spill prevention controls, countermeasures, and procedures would be employed to minimize the chance for petroleum, oils, lubricants, and other materials used during construction to be released to the surface or subsurface and to ensure that waste materials are properly disposed of. Waste generation and management activities are detailed in Section 4.2.11.1. In general, minimal impact on groundwater availability or quality is anticipated.

Operations Impacts—Facilities supporting RPS nuclear production operations at MFC would use groundwater primarily to meet the potable and sanitary needs of facility support personnel, as well as for miscellaneous building physical plant uses. Total annual water usage is estimated at 74.4 million liters (19.7 million gallons). As this demand would be a small fraction of existing INL and MFC usage and would not exceed site capacity (see Table 4–12), no additional measurable impact on regional groundwater levels or availability is anticipated.

No sanitary or industrial effluent would be directly discharged to the surface or subsurface, as discussed in Section 4.2.4.1. Waste generation and management activities are detailed in Section 4.2.11.1. Thus, minimal operational impacts on groundwater quality are expected.

4.2.5 Air Quality and Noise

4.2.5.1 Air Quality

Nonradiological Releases

It is estimated that there would be no measurable nonradiological air pollutant emissions at INL associated with storage of neptunium-237 in FMF and irradiation of neptunium-237 targets in ATR. Therefore, there would be no nonradiological air quality impacts of these activities (DOE 2000f).

Construction and Operations Impacts—of the new Plutonium-238 Facility at MFC, Support Building, and Radiological Welding Laboratory at MFC at INL would result in temporary increases in criteria and toxic pollutant emissions. The sources of these emissions would include diesel- and gasoline-fueled construction equipment, employee and shipping vehicles, and exposed soil, resulting in suspension of PM by equipment activity and wind. These emissions are not expected to result in the ambient standards being exceeded. Measures such as watering would be used to mitigate any potential impacts of PM emissions during construction (DOE 2002c).

Air pollutant concentrations at INL attributable to neptunium-237 target fabrication and processing activities and plutonium-238 purification, pelletization, and encapsulation operations at MFC at INL are presented in **Table 4–15**. The increase in emissions would be from increased operation of the four boilers to provide heat for the facilities and testing of an emergency diesel generator. The increase in emissions was assumed to be proportional to the increase in square footage, which is about 20 percent. This increase in use of the boilers would be well within the capacity of the existing boilers. Each of the boilers has a specific permit limit on the level of emissions. Operations would not result in the boilers exceeding their permitted levels of emissions. The concentrations are based on a dispersion-modeling screening analysis conducted with maximum expected emission rates and a set of worst-case meteorological conditions. Criteria pollutants were modeled for a stack height of 15 meters (50 feet) at the boundary limit of 6.4 kilometers (4 miles). The concentrations were determined to be small and would be below the applicable standard even when ambient monitored values and the contributions from other site activities were included. Small quantities of toxic air pollutants would be emitted from operation of this facility. Emissions would include small quantities of solvents from cleaners and adhesives, alcohol, leak-test fluids, lubricants, and acids. Health effects of hazardous chemicals associated with this alternative are addressed in Section 4.2.9.

Table 4–15 Incremental Idaho National Laboratory Air Pollutant Concentrations [a] Associated with Operating Facilities Under the Consolidation Alternative

Pollutant	*Averaging Period*	*Most Stringent Standard (micrograms per cubic meter)*	*Modeled Increment (micrograms per cubic meter)*
Carbon monoxide	8 hours 1 hour	10,000 40,000	0.076 0.11
Nitrogen dioxide	Annual	100	0.025
PM_{10}	Annual 24 hours	50 150	0.0020 0.016
$PM_{2.5}$	Annual 24 hours	15 65	0.0020 [b] 0.016 [b]
Sulfur dioxide	Annual 24 hours 3 hours	80 365 1,300	0.041 0.33 0.74

PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers.
[a] For comparison with ambient air quality standards.
[b] Assumed to be the same as PM_{10}, as data for $PM_{2.5}$ were not available.
Source: Modeled increments are based on the SCREEN3 computer code and emission estimates for increased boiler use, INL 2005c.

The primary source of criteria pollutant emissions from operation of the Assembly and Testing Facility for RPS assembly and testing would be from burning fuel oil in the boilers that provide heat and power for the facilities at INL. As described above, each of the boilers has a specific limit on the level of emissions. Operation of the Assembly and Testing Facility would not result in the boilers exceeding their permitted levels of emissions. Small quantities of toxic air pollutants would be emitted from use of small quantities of various chemicals for assembly and testing operations (DOE 2002c).

Construction of the proposed new road from MFC to ATR at INL would result in temporary increases in criteria and toxic pollutant emissions. The sources of these emissions would include diesel- and gasoline-fueled construction equipment, construction worker and delivery vehicles, and exposed soil resulting in suspension of PM by equipment activity and wind. Actual equipment use would be intermittent and would depend on the phase of construction activity and the construction schedule. It is expected that most of the new road construction would be performed during daytime hours. These emissions are not expected to result in the ambient standards being exceeded. Measures such as watering would be used to mitigate any potential impacts of PM emissions during construction (INL 2005c).

Increases in air pollutant emissions from operations under this alternative are expected to be small and not subject to PSD regulations. Therefore, a PSD increment analysis is not required (see Section B.4.1).

The Final Rule for "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" requires a conformity determination for certain-sized projects in nonattainment areas. DOE has performed a review for this alternative and concluded that a conformity determination is not necessary to meet the requirements of the Final Rule, because INL is located in an attainment area for all criteria pollutants, and threshold emission levels would not be exceeded by the activities considered (DOE 2000c). See Section D.5.2 for a discussion of the human health risks from pollutants emitted by transport vehicles.

Radiological Releases

Construction Impacts—While no radiological releases to the environment are expected in association with RPS consolidation construction activities at MFC, the potential exists for contaminated soils and possibly other media to be disturbed during excavation and other site activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the extent and nature of contamination and would be required to clean-up contamination in accordance with procedures established under INL's Environmental Restoration Program and INL's Hazardous Waste Facility Permit.

Operations Impacts—Radioactive releases associated with storage of neptunium-237 at FMF would be essentially zero, as the canisters containing the neptunium-237 would remain in containment vessels during storage. An estimated 1.7×10^{-7} curies per year of plutonium-238 could be released to the environment during target fabrication and post-irradiation processing operations, and about 1.0×10^{-8} curies per year of plutonium-238 could be released to the environment from purification, pelletization, and encapsulation operations at the Plutonium Facility at LANL and the Plutonium-238 Facility at MFC (see Section C.2.1.4). There would be no incremental releases to the environment from ATR during target irradiation, because there would be no increase in activities in this reactor due to additional target irradiation. No releases are expected from the RPS Assembly and Testing Facility at MFC, because the facility would handle only fully encapsulated radioactive material. There would be no other types of radiological releases from RPS nuclear production operations. Impacts of radiological releases are discussed in Section 4.2.9.

4.2.5.2 Noise

Construction Impacts— Construction of the new Plutonium-238 Facility, Support Building, and Radiological Welding Laboratory at MFC at INL would result in minor and temporary construction noise. This noise would be typical of other construction projects at INL and would result in minor noise impacts onsite near the facility. Offsite noise levels would not be noticeable, as the nearest site boundary is 6.4 kilometers (4 miles) to the south-southeast.

Construction of the new road from MFC to ATR would result in minor and temporary construction noise. Noise sources from road construction would include trucks, generators, graders, scrapers, dozers, backhoes, asphalt pavers, compactors, and front-end loaders. The noise would be typical of other construction projects at INL, except the noise would be dispersed along the road. It is expected that most of the road construction would be performed during daytime hours, and that this work would result in minor noise impacts onsite along the route. Offsite noise impacts would be minor, as the nearest site boundary is more than 6.4 kilometers (4 miles) distant (INL 2005c).

Operations Impacts—Operations in FMF and the Assembly and Testing Facility at MFC, and the ATR at RTC, would generate noise levels similar to those presently associated with operations conducted in these areas of INL. Onsite noise impacts are expected to be minimal, and offsite noise levels should not be noticeable, as the nearest site boundary is 6.4 kilometers (4 miles) from MFC and 11 kilometers (6.8 miles) from RTC. Increases in traffic would be small and would result in only minor on and offsite noise levels. There would be no loud noises associated with these operations that would adversely impact wildlife (DOE 2000f, 2002c).

Noise associated with neptunium-237 target fabrication and processing at the new Plutonium-238 Facility at MFC would be similar to sound levels generated by other operations at MFC. Onsite noise impacts are expected to be minimal, and offsite noise levels would not be noticeable because the nearest site boundary is 6.4 kilometers (4 miles) to the south-southeast. Traffic associated with neptunium-237 target fabrication and processing activities at the Plutonium-238 Facility at MFC would be minor and would not lead to noticeable noise levels either on or offsite. There would be no loud noises associated with target fabrication and processing that would adversely impact wildlife.

4.2.6 Ecological Resources

Construction Impacts—A number of existing INL facilities would be used under the Consolidation Alternative. These include FMF (for storage of neptunium-237), ATR (for neptunium-237 target irradiation), and the Assembly and Testing Facility (for RPS assembly and testing). There would be no impacts on ecological resources of use of these facilities under this alternative, as they are existing facilities within developed areas, and their use would not result in a meaningful increase in noise or change in water use or wastewater discharge.

Operations Impacts—Measurable impacts on populations of plants and animals on or off INL are not expected as a result of the incremental increase in exposure to radionuclides or chemicals that could result from operation of facilities under this alternative. DOE routinely samples game species residing on INL, livestock that have grazed on INL, locally grown crops, and milk around INL for radionuclides. The results of this monitoring are reported in the *INEEL Site Environmental Report*, prepared each year. Concentrations of radionuclides in the plant and animal samples have been small and are seldom higher than concentrations observed at control locations distant from INL (DOE 2002e). Additional deposition resulting from implementation of this alternative is not expected to lead to levels of contaminants that would exceed the historically reported ranges of concentrations. Therefore, DOE anticipates minimal impacts on the ecology of INL, and on plant and animal populations, as a result of exposure to radionuclides or chemicals under this alternative.

4.2.6.1 Terrestrial Resources

Construction Impacts—Under the Consolidation Alternative, new construction would take place at INL. Because the Radiological Welding Laboratory (an addition to existing Building 772) would be constructed within the highly developed portion of MFC, direct impacts on terrestrial resources are not expected. Indirect impacts of noise and other disturbance associated with construction could briefly impact wildlife in the immediate area, but such impacts would be minimal, as wildlife use of the area is minimal, and noise impacts would be short term. Any new lighting associated with the Radiological Welding Laboratory would be minimal and is not expected to affect wildlife.

Construction of the Plutonium-238 Facility and associated Support Building at MFC would take place within a currently undeveloped portion of MFC located immediately south of the existing fence line (see Figure 2–9). Construction would disturb 24 hectares (60 acres); however, only 12 hectares (30 acres) would be permanently disturbed once construction is complete (INL 2005c). Construction would remove all vegetation within this area, which consists of big sagebrush habitat, as well as some areas that have been replanted to crested wheatgrass. Although plant communities in which big sagebrush is the dominant overstory species are well represented on INL, they are relatively uncommon regionally because of widespread conversion of shrub-steppe habitats to agriculture. Mitigation could include reestablishment of shrub-steppe habitat on the 12 hectares (30 acres) disturbed during construction but not required during operations.

Construction of the Plutonium-238 Facility at MFC would affect animal populations. Less-mobile animals within the project area, such as reptiles and small mammals, are not expected to survive. Nests of birds would also be destroyed if construction occurred during the nesting season. To minimize impacts on migratory birds, which are protected under the Migratory Bird Treaty Act, ground disturbance could be scheduled to avoid the breeding season. Construction activities and noise would cause larger mammals and birds to move to similar habitat nearby. Noise and human disturbance could be minimized by properly maintaining equipment and clearly marking the limits of the construction area.

The northern most route connecting MFC and ATR, generally following the T-3 Road, would traverse 24 kilometers (15 miles) of big sagebrush and grassland habitat. During construction of the new road at INL, up to 51 hectares (125 acres) would be disturbed with a construction right-of-way of 18 meters (60 feet) (INL 2005c). The actual acreage of natural habitat disturbed would be somewhat less, as a portion of the road would utilize the existing T-3 Road right-of-way. Impacts on vegetation and wildlife would be similar to those described above for the Plutonium-238 Facility at MFC. However, potential disturbance resulting from noise and human activity during construction would be greater. Thus, mitigation measures, such as proper maintenance of equipment, restricting all activity to the construction right-of-way, and avoiding construction during the breeding season, would be especially important. Also, elk, pronghorn, and mule deer are found in the area of the road and could be disturbed by its construction and use. Adjusting construction timing may mitigate some of these impacts. Although the potential exists for collisions with wildlife when material is being shipped along the new road, its limited use and 55-kilometer-per-hour (35-mile-per-hour) speed limit are expected to minimize this impact. Impacts of construction and operation of the two southerly routes would involve less land disturbance because less new road would be required (INL 2005c). Therefore, impacts from land disturbance would be less. In addition, the East Power Line Road is maintained to a higher level of service than the T-3 and T-24 Roads. This would likely result in less disruption to ecological resources if this route was selected. In any event additional surveys would be conducted prior to any decision to determine the exact nature of the ecological resources along each route.

Operations Impacts—Activities associated with operation of the Plutonium-238 Facility at MFC, such as noise and human activity, could affect wildlife living in the immediate area. These disturbances may cause some species to move from the area. Disturbance to wildlife would be minimized by preventing workers from entering undisturbed areas. Those portions of the site disturbed by construction, but not occupied by facility structures, would be landscaped. Such areas would be of minimal value to wildlife. Because MFC is presently lit at night, the additional lighting associated with the Plutonium-238 Facility at MFC is not expected to further affect site wildlife present in the vicinity.

4.2.6.2 Wetlands

Construction and Operations Impacts—There would be no impacts on wetlands of the Plutonium-238 Facility construction, as there are no wetlands located within or in the vicinity of the proposed facility site. Although one of the potential routes for the new road connecting MFC and ATR would cross the Big Lost River and may require construction of a new bridge, wetland vegetation along the river is in poor condition because of only intermittent flows in recent years. Further, wetlands in this area have not been designated as jurisdictional by the U.S. Army Corps of Engineers and, thus, are not regulated under Section 404 of the Clean Water Act. Nevertheless, a Preliminary Floodplain/Wetland Assessment has been prepared for this proposed activity in accordance with 10 CFR 1022 (see Appendix F of this EIS). Construction of a new bridge would use best management practices to minimize disturbance and erosion potential. The nearest jurisdictional wetland, the Big Lost River Sinks, located 21 kilometers (13 miles) north of the proposed river crossing, would not be affected by construction of the new road.

4.2.6.3 Aquatic Resources

Although the waste disposal ponds provide habitat for a variety of aquatic invertebrates, there is no natural aquatic habitat within MFC. Because construction and operation of the Plutonium-238 Facility at MFC would not impact the waste ponds and there is no natural aquatic habitat in the area, there would be no impacts on aquatic resources under this alternative.

One of the potential routes for the new road connecting the MFC and ATR passes across the Big Lost River. Because this river remains dry for extended periods of time, there are no fish or other aquatic species present within its channel. Thus, construction of a bridge over the channel would not be expected to result in any adverse impacts to aquatic resources. Regardless, best management practices would limit disturbance of the dry river channel.

4.2.6.4 Threatened and Endangered Species

Construction and Operations Impacts—Construction of the Plutonium-238 Facility at MFC is not expected to impact any threatened or endangered species, or other sensitive species, as no such species have been observed within the proposed site area (see Section 3.2.6.4). Although the rattlesnake is not threatened or endangered, it is protected in Idaho. As it is possible that snakes using the hibernacula located 0.62 kilometers (1 mile) south of MFC could migrate to the site in the spring, construction could result in the loss of some of these animals. However, depending on when ground clearing activities took place, snakes present within the site area could be removed to another location.

As noted in Section 3.2.6.4, no Federally or state-listed threatened or endangered species have been observed along any of the three proposed routes connecting the MFC and ATR. However, the potential exists for a number of special status species to be found along each route. In fact, the sage grouse, pygmy rabbit, and ferruginous hawk have been found along the T-3 Road. Regardless of the route selected, the potential exists to impact sensitive species both directly and indirectly during construction. A survey of each route would be conducted prior to any decision to document the presence of sensitive species. Based on the results of the surveys, mitigation measures such as adjustments in the specific route chosen, not clearing the route right-of-way during the breeding season, and preventing workers from leaving the construction right-of-way would help lessen potential impacts.

Consultation to comply with Section 7 of the Endangered Species Act (16 U.S.C. 1531 *et seq*.) was initiated with the U.S. Fish and Wildlife Service and state wildlife officials, and responses are pending. No decision would be made relative to the construction of any proposed facilities, or the new road prior to completion of the consultation process.

4.2.7 Cultural Resources

Construction and Operations Impacts—Under the Consolidation Alternative, construction of the Plutonium-238 Facility at MFC, Support Building, Radiological Welding Laboratory, and a new road between ATR and MFC are proposed at INL (INL 2005c). The proposed Radiological Welding Laboratory, an addition to existing Building 772, would be constructed within the fenced area at MFC under this alternative. Although 12 isolated prehistoric finds and two archaeological sites were located within this area, most of the land in this area is highly disturbed and not likely to yield any new significant archaeological or historic material. The Experimental Breeder Reactor-II, designated as a Nuclear Historic Landmark by the American Nuclear Society, would not be impacted by construction of this proposed addition.

As shown in Figure 2–12, there are three possible routes the new road could take between MFC and RTC. One route would follow the existing unimproved T-3 Road. The T-3 Road is classified as a historic stagecoach trail and is also know as and the Lost River/Arco Road. The existence of this road has been documented from 1917, but it is believed this road was used since 1888. No archaeological, prehistoric or historical surveys have been conducted along this road, but there are several historic home sites along the road, including one within INL boundaries. Pavement would be required for 24 kilometers (15 miles) from MFC until the new road connects to internal INL roads leading to RTC (INL 2005c).

If this route is selected, a cultural resources study would be conducted prior to any construction. The survey would also determine if any pioneer homesteads are located along this section of the T-3 Road. Specific concerns about the presence, type, and location of American Indian resources, including any resources located near "Aviators Cave" (INL 2005c), would be addressed through consultation with potentially affected tribes in accordance with the *Agreement-in-Principle between the Shoshone-Bannock Tribes and the United States Department of Energy*, dated December 10, 2002, as well as the National Historic Preservation Act, Native American Graves Protection and Repatriation Act, and American Indian Religious Freedom Act.

The T-24 Road is located south of the T-3 Road. Approximately 16 kilometers (10 miles) would need to be paved from MFC until the road reaches CITRC and connects to internal roads leading to RTC. This road has been partially surveyed for cultural resources, is not classified as a historic trail, and was probably constructed sometime after 1950 (INL 2005c).

The East Power Line Road is currently maintained to a higher level than the other two jeep trails because of ongoing activities related to power line maintenance. Approximately 19 kilometers (12 miles) would need to be paved before the new road connects to internal INL paved roads at CITRC. A number of cultural consultations and mitigations have been conducted along the Power Line Road (INL 2005c).

If this alternative is selected, any prehistoric or historic resources, including those that are or may be eligible for listing on the National Register of Historic Places, would be identified. These resources would be identified through site surveys and consultation with the State Historic Preservation Officer. Consultation to comply with Section 106 of the National Historic Preservation Act (16 U.S.C. 470 *et seq*.) was initiated with the Idaho State Historic Preservation Office. No decision would be made relative to use of existing buildings, construction of any proposed facilities, or the new road prior to completion of the consultation process.

Consultation with potentially affected American Indian tribal governments has been initiated, and a response is pending. No decision would be made relative to construction of any proposed facilities or the new road prior to completion of the consultation process.

4.2.8 Socioeconomics

Construction Impacts—Modifications to existing MFC facilities at INL and construction of the new buildings and road would require a peak construction employment level of 245 workers (INL 2005c). This level of employment would generate about 237 indirect jobs in the region around INL. The potential total employment increase of 482 direct and indirect jobs represents an approximate 0.4 percent increase in the workforce and would occur only during the 22 months of construction. It would have little to no noticeable impact on the socioeconomic conditions of the ROI. Since the employment requirements in support of construction at INL would be relatively small, the increase in traffic volume would also be small and not likely to be noticed by commuters in the vicinity of INL.

Operations Impacts—The consolidation of RPS nuclear production operations at MFC could result in the permanent relocation or hiring of approximately 75 new employees (INL 2005c). This level of employment would generate about 72 indirect jobs in the region around INL. The potential total employment increase of 147 direct and indirect jobs represents an approximate 0.1 percent increase in the workforce. The increase in the number of workers in support of consolidated RPS nuclear operations would have little or no noticeable impact on socioeconomic conditions in the INL ROI. Workers assigned to the new RPS nuclear production facilities would be drawn for the most part from the existing INL workforce. The contributory effect of the remaining new employment, in combination with potential effects of other industrial and economic sectors within the regional economic area, would serve to reduce or mask any effect on the regional economy. New MFC employees hired to support the production of RPSs would compose a small fraction of the INL workforce (8,100 in 2001) and an even smaller fraction of the regional workforce (more than 92,000 in 1999). Since the employment requirements in support of consolidated RPS nuclear production operations at INL would be small, the increase in traffic volume at INL from RPS nuclear production at MFC would also be small and not likely to be noticed by commuters in the vicinity of INL.

Under the Consolidation Alternative, target fabrication and processing operations at REDC would not start up. Therefore, there would be no impacts on socioeconomic conditions in the ORNL region. Operations at the Plutonium Facility at LANL currently employ a small number of non-dedicated workers. There would be no impacts on socioeconomic conditions in the LANL region since these workers would continue to be employed handling other radioactive materials.

4.2.9 Public and Occupational Health and Safety

Assessments of radiological and chemical impacts at INL during normal operations and accident conditions associated with the Consolidation Alternative are presented in this section. Supplemental information is provided in Appendix C of this EIS. Radiological and chemical impacts during normal operations and accident conditions at LANL from purification, pelletization, and encapsulation operations from 2007 to 2011 would be the same as described under the No Action Alternative.

4.2.9.1 Construction and Normal Operations

No routine radiological or hazardous chemical releases are expected during construction activities. During normal operations, there could be incremental radiological and hazardous chemical releases to the environment and incremental direct in-plant exposures. The resulting doses and potential health effects on the public and workers under this alternative are described below.

Radiological Impacts

Incremental radiological doses to three receptor groups from operations at INL are given in **Table 4–16:** the population within 80 kilometers (50 miles) in the year 2050, the MEI, and the average exposed member of the public. The projected number of excess LCFs in the surrounding population and the excess LCF risk to the MEI and average exposed individual are also presented in the table. A probability coefficient of 6×10^{-4} LCFs per rem is applied for the public and workers.

Table 4–16 Incremental Radiological Impacts on the Public of Facility Operations at Idaho National Laboratory Under the Consolidation Alternative

Receptor	*INL*	
	MFC	*ATR* [a]
Population within 80 kilometers (50 miles) in the year 2050		
Dose (person-rem)	1.9×10^{-5}	No change
35-year period excess latent cancer fatalities	4.1×10^{-7}	No change
Maximally exposed individual		
Annual dose (millirem)	1.6×10^{-6}	No change
35-year excess latent cancer fatality risk	3.4×10^{-11}	No change
Average exposed individual within 80 kilometers (50 miles)		
Annual dose [b] (millirem)	5.4×10^{-8}	No change
35-year excess latent cancer fatality risk	1.1×10^{-12}	No change

INL = Idaho National Laboratory, MFC = Materials and Fuels Complex, ATR = Advanced Test Reactor.

[a] There would be no incremental radiological impacts of operation of ATR or HFIR because the insertion of targets does not affect reactor operating conditions or contribute a new source of radiological emissions.

[b] Obtained by dividing the population dose by the number of people projected to live within 80 kilometers (50 miles) of the site in the year 2050 (ATR at INL = 172,200; MFC at INL = 355,000).

Doses at INL would be attributed to all RPS production activities performed at MFC. This includes storage of target materials at FMF; fabrication and post-irradiation processing at the Plutonium-238 Facility; purification, pelletization, and encapsulation activities at the Plutonium-238 Facility; and assembly and test operations at the Assembly and Testing Facility. The alternative does not include activities at any other sites.

There would be no incremental dose to the MEI from annual ATR operations because there would be no increase in radiological releases to the environment under this alternative.

The annual population dose at INL would be 1.9×10^{-5} person-rem, with a 35-year excess LCF risk of 4.1×10^{-7}. The annual MEI dose would be 1.6×10^{-6} millirem per year, with a 35-year excess LCF risk of 3.4×10^{-11}. The annual average exposed individual dose would be 5.4×10^{-8} millirem per year, with an excess LCF risk of 1.1×10^{-12}.

Doses to involved workers from normal operations are given in **Table 4–17**; these workers are defined as those directly associated with process activities. The incremental annual average dose to workers at ATR would be negligible, and approximately 32 person-rem to workers at MFC. Doses to individual workers would be kept to minimal levels by instituting badged monitoring and ALARA programs.

Table 4–17 Incremental Radiological Impacts on Involved Workers of Facility Operations at Idaho National Laboratory Under the Consolidation Alternative

Receptor—Involved Workers [a]	*INL*	
	MFC	*ATR* [b]
Total dose (person-rem per year)	32	No change
35-year period excess latent cancer fatalities	0.68	No change
Average worker dose (rem per year)	0.49 [c]	No change
35-year excess latent cancer fatality risk	0.010	No change

INL = Idaho National Laboratory, MFC = Materials and Fuels Complex, ATR = Advanced Test Reactor.

[a] The radiological limit for an individual worker is 5,000 millirem per year (10 CFR 835). However, the maximum dose to a worker involved with operations would be kept below the DOE Administrative Control Level of 2,000 millirem per year (DOE 1999e). Further, DOE recommends that facilities adopt a more limiting, 500-millirem-per-year, Administrative Control Level (DOE 1999e). To reduce doses to ALARA levels, an effective ALARA program would be enforced.

[b] There would be no incremental radiological impacts of operation of ATR or HFIR because the insertion of targets does not affect reactor operating conditions or contribute a new source of radiological emissions.

[c] Based on an estimated 65 badged workers (INL 2005c).

Hazardous Chemical Impacts

Hazardous chemical impacts at INL would be unchanged from baseline site operations because no new chemicals would be emitted to the air from storage of neptunium-237 in FMF at MFC or continued operation of ATR (DOE 2000f). Impacts of hazardous chemical emissions due to target fabrication and post-irradiation processing operations, are expected to be less than those reported for REDC at ORNL under the No Action Alternative. This is due to the new, modern facilities at MFC and the longer distance to a public receptor compared to the REDC at ORNL. Therefore, no chemical health effects are anticipated at INL under the Consolidation Alternative.

Nonradioactive air emissions from activities at the Plutonium Facility at LANL would be mainly from the glovebox gases argon and helium. These are inert and nonhazardous. Ethanol, used as a solvent at LANL, is likewise not hazardous. Vapors of hydrofluoric and nitric acids, used in decontamination, would be emitted at rates well below threshold values (DOE 1991).

4.2.9.2 Facility Accidents

This section discusses potential accident impacts under the Consolidation Alternative. Under accident conditions, there could be impacts at INL associated with storage of neptunium-237 in the FMF vault; target fabrication, post-irradiation processing, and plutonium-238 purification, pelletization, and encapsulation in the new Plutonium-238 Facility at MFC; assembly and test operations in the Assembly and Testing Facility; and target irradiation at ATR. The accident scenarios chosen for analysis have impacts that bound the suite of accidents that have occurred, and could occur, at the facilities. The selection of accident scenarios described in Appendix C of this EIS included the review of accident history as presented in Sections 3.2.9.4, 3.3.9.4, and 3.4.9.4. The accident scenarios that were analyzed result in higher public and noninvolved worker risks than historic accidents.

Incremental radiological doses to three receptor groups from postulated accidents at INL are estimated: the population within 80 kilometers (50 miles), the MEI of the public, and the noninvolved worker. The projected number of excess LCFs in the surrounding population and the excess LCF risk to the MEI and noninvolved worker are also presented. A probability coefficient of 6×10^{-4} LCFs per rem is applied for the public and workers.

Radiological Impacts

The sealed design of the plutonium-238 heat sources, which will be shipped from Pantex and LANL to INL, is not expected to cause any radiological risks from credible accidents. Potential impacts of neptunium-237 storage and target irradiation accidents under the Consolidation Alternative have been evaluated by DOE in previous NEPA documents (DOE 2000f, 2002c).

Neptunium-237 Storage—At INL, neptunium-237 would be stored in the FMF vault. The FMF vault has 100 in ground concrete storage silo positions sealed with 5.1-centimeter (2-inch) stainless steel shielding plugs. The neptunium-237 storage cans would be placed in a rack inside the silo. While the postulated beyond-design-basis earthquake may cause portions of the facility to collapse, the storage cans would not be stressed to a level that would breach the double containment of the can design (DOE 2000f).

Target Irradiation—For ATR target irradiation accidents, the 35-year increased risk of an LCF to the offsite MEI and a noninvolved worker associated with plutonium-238 production at INL would be 1.8×10^{-7} and 2.9×10^{-6}, respectively. The 35-year accident risk in terms of the increased number of LCFs in the offsite population would be 7.0×10^{-4}. These target irradiation accident risks were calculated in the *NI PEIS* (DOE 2000f).

Assembly and Testing Operations—A range of accidents were considered for the Assembly and Testing Facility, including welding fire accidents, catastrophic failure of one or more of the fuel elements, and the potential for a wind-driven missile to penetrate a facility wall and glovebox. However, because of the solid ceramic form of the plutonium and the multiple protective features of the Category 3 building, any release to the environment from these accidents would be negligible. Any adverse effects would be mitigated by air filtration systems, room and building barriers, and air locks that contain releases (DOE 2002c). Because the probability of occurrence and release of radioactive materials outside of the building for these accidents was estimated to be less than 1 in 1 million per year, the risks to noninvolved workers and the public were not considered further.

Target Fabrication and Post-irradiation Processing—The consequences and risks of target processing accidents are shown in **Table 4–18**. Four potential accidents were postulated:

- A neptunium-237 target preparation ion exchange explosion. The estimated frequency of this accident is 1×10^{-2} per year.
- A plutonium-238 separation tank failure. The estimated frequency of this accident is 1×10^{-2} per year.
- An explosion of a plutonium-238 ion exchange column. The estimated frequency of this accident is 1×10^{-2} per year.

- A beyond-evaluation-basis earthquake, resulting in a collapse of the nearby stack and failure of the HEPA filter system intended to mitigate the consequences of releases. The estimated frequency of this accident is 1×10^{-5} per year.

Table 4–18 Target Processing Accident Consequences at Idaho National Laboratory Under the Consolidation Alternative

	Maximally Exposed Individual		*Population to 80 Kilometers (50 miles)*		*Noninvolved Worker*	
Accident	*Dose (rem)*	*Latent Cancer Fatality* [a]	*Dose (person-rem)*	*Latent Cancer Fatalities* [b]	*Dose (rem)*	*Latent Cancer Fatality* [a]
Neptunium-237 target preparation ion exchange	5.2×10^{-9}	3.1×10^{-12}	7.9×10^{-7}	4.8×10^{-10}	7.2×10^{-8}	4.3×10^{-11}
Plutonium-238 separation tank failure	1.3×10^{-7}	7.5×10^{-11}	2.8×10^{-5}	1.7×10^{-8}	1.9×10^{-6}	1.1×10^{-9}
Plutonium-238 ion exchange explosion	4.9×10^{-4}	3.0×10^{-7}	7.4×10^{-2}	4.5×10^{-5}	6.9×10^{-3}	4.1×10^{-6}
Beyond-evaluation-basis earthquake	8.4	5.0×10^{-3}	4.0×10^{3}	2.4	2.0×10^{2}	2.3×10^{-1}

[a] Likelihood of an LCF.
[b] Number of LCFs.

The risks of the postulated accidents are shown in **Table 4–19**. The accident with the highest risk is a beyond-evaluation-basis earthquake. If this accident were to occur, the annual risk of an LCF would be 5.0×10^{-8} and 2.3×10^{-6} for the MEI and noninvolved worker, respectively. The annual risk for the offsite population would be 2.4×10^{-5}. The 35-year risk for the highest-consequence accident, a beyond-evaluation-basis earthquake, for the MEI, noninvolved worker, and offsite population would be 1.8×10^{-6}, 8.2×10^{-5}, and 8.4×10^{-4}, respectively.

Table 4–19 Target Processing Annual Accident Risks at Idaho National Laboratory Under the Consolidation Alternative

Accident	*Maximally Exposed Individual* [a]	*Population to 80 Kilometers* [b] *(50 miles)*	*Noninvolved Worker* [a]
Neptunium-237 target preparation ion exchange	3.1×10^{-14}	4.8×10^{-12}	4.3×10^{-13}
Plutonium-238 separation tank failure	7.5×10^{-13}	1.7×10^{-10}	1.1×10^{-11}
Plutonium-238 ion exchange explosion	3.0×10^{-9}	4.5×10^{-7}	4.1×10^{-8}
Beyond-evaluation-basis earthquake	5.0×10^{-8}	2.4×10^{-5}	2.3×10^{-6}

[a] Increased likelihood of an LCF.
[b] Increased number of LCFs.

Plutonium-238 Purification, Pelletization, and Encapsulation—The consequences and risks of plutonium-238 purification, pelletization, and encapsulation accidents are shown in **Table 4–20**. Four potential accidents were postulated:

- An unmitigated evaluation-basis fire during plutonium-238 powder-to-pellet fabrication. Unmitigated conditions assume failure of HVAC and fire suppression systems. The estimated frequency of this accident is 1×10^{-5} per year.

- An unmitigated evaluation-basis earthquake (0.3-g acceleration), causing failure of the HVAC, fire safety equipment, nonsafety-class ductwork, and internal nonsafety-grade structures, but not the structure shell itself. The estimated frequency of this accident is 5×10^{-4} per year.

- A beyond-evaluation-basis fire similar to the evaluation-basis fire, but involving two gloveboxes and the assumption that exterior doors are open for the duration of the fire, providing a direct unfiltered release to the environment. The estimated frequency of this accident is 1×10^{-6} per year.
- A beyond-evaluation-basis earthquake (0.5-g), with all the same assumed failures as the evaluation-basis-earthquake but in addition, a 50-percent degradation in HEPA filter removal efficiency. The estimated frequency of this accident is 1×10^{-4} per year.

Table 4–20 Plutonium-238 Purification, Pelletization, and Encapsulation Annual Accident Consequences at Idaho National Laboratory Under the Consolidation Alternative

Accident	*Maximally Exposed Individual*		*Population to 80 Kilometers (50 miles)*		*Noninvolved Worker*	
	Dose (rem)	*Latent Cancer Fatality* [a]	*Dose (person-rem)*	*Latent Cancer Fatalities* [b]	*Dose (rem)*	*Latent Cancer Fatality* [a]
Unmitigated evaluation-basis fire	0.70	4.2×10^{-4}	228	0.14	15.60	0.0094
Unmitigated evaluation-basis earthquake	0.27	1.6×10^{-4}	169	0.10	6.38	0.0038
Beyond-evaluation-basis fire	0.42	2.5×10^{-4}	84.2	0.051	7.87	0.0047
Beyond-evaluation-basis earthquake	0.04	2.5×10^{-5}	20	0.012	0.97	0.00058

[a] Likelihood of an LCF.
[b] Number of LCFs.

The risks of the postulated accidents are shown in **Table 4–21**. The accident with the highest risk is an unmitigated evaluation-basis earthquake. If this accident were to occur, the annual risk of an LCF would be 8.2×10^{-8} and 1.9×10^{-6} for the MEI and noninvolved worker, respectively. The annual risk for the offsite population would be 5.1×10^{-5}. The 35-year risk for the highest-consequence accident, an unmitigated evaluation-basis earthquake, for the MEI, noninvolved worker, and offsite population would be 2.9×10^{-6}, 6.7×10^{-5}, and 1.8×10^{-3}, respectively.

Table 4–21 Plutonium-238 Purification, Pelletization, and Encapsulation Annual Accident Risks at Idaho National Laboratory Under the Consolidation Alternative

Accident	*Maximally Exposed Individual* [a]	*Population to 80 Kilometers (50 miles)* [b]	*Noninvolved Worker* [a]
Unmitigated evaluation-basis fire	4.2×10^{-9}	1.4×10^{-6}	9.4×10^{-8}
Unmitigated evaluation-basis earthquake	8.2×10^{-8}	5.1×10^{-5}	1.9×10^{-6}
Beyond-evaluation-basis fire	2.5×10^{-10}	5.1×10^{-8}	4.7×10^{-9}
Beyond-evaluation-basis earthquake	2.5×10^{-9}	1.2×10^{-6}	5.8×10^{-8}

[a] Increased likelihood of an LCF.
[b] Increased number of LCFs.

Hazardous Chemical Impacts

Storage of neptunium-237 in FMF would not involve hazardous chemicals. Thus, no hazardous chemical accidents would be associated with storage of neptunium-237 in FMF at INL (DOE 2000f).

Irradiation of neptunium-237 targets at ATR would not introduce any additional operations that require the use of hazardous chemicals. Thus, no postulated hazardous chemical accidents would be attributable to irradiation of neptunium-237 targets at ATR (DOE 2000f).

Plutonium-238 processing at INL would involve a variety of chemicals that are potentially hazardous to workers and the public. Based on an anticipated annual inventory of 40 chemicals (DOE 2000f), two—nitric acid and hydrochloric acid—were selected for evaluation of potential impacts based on their large quantities, chemical properties, and health effects. **Table 4–22** shows the estimated stored quantities and levels of concern for these two chemicals.

Table 4–22 Chemicals of Concern Used in the Plutonium-238 Facility at Idaho National Laboratory Under the Consolidation Alternative

Chemical	*Inventory (kilograms)*	*ERPG-1* [a] *Concentration*	*ERPG-2* [b] *Concentration*	*ERPG-3* [c] *Concentration*
Nitric acid	984	1 ppm	6 ppm	78 ppm
Hydrochloric acid	146	3 ppm	20 ppm	150 ppm

ERPG = Emergency Response Planning Guideline, ppm = parts per million.

[a] ERPG-1 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odor (NOAA 2005).

[b] ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (NOAA 2005).

[c] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (NOAA 2005).

Note: To convert from kilograms to pounds, multiply by 2.2046.

Source: DOE 2000f.

The postulated accident is a catastrophic release of either of the chemicals as a result of a break in a storage vessel or piping. The cause of the break could be mechanical failure, corrosion, mechanical impact, or natural phenomena. The estimated frequency of the accident is in the range of 1.0×10^{-5} to 1.0×10^{-4} per year. The potential impacts of an accidental chemical release are shown in **Table 4–23**. The distances to the Emergency Response Planning Guideline (ERPG) -2 and -3 levels of concern are 128 and 21 meters (140 and 23 yards), respectively, for a nitric acid release. The distances to the ERPG-2 and -3 levels of concern are 232 and 80 meters (254 and 87 yards) respectively, for a hydrochloric acid release. Depending on the magnitude of the release and plume characteristics, workers and members of the public could be exposed to harmful concentrations of each chemical within these distances from the point of release. Table 4–23 also shows the estimated concentration of each chemical at a distance of 640 meters (700 yards) from the release point where a representative noninvolved worker is assumed to be located. The seriousness of the exposure of a noninvolved worker at this distance is determined by comparing the concentration at that distance to the ERPG-2 and -3 levels of concern. Table 4–23 also shows the estimated concentration at the nearest site boundary located at a distance of 5.2 kilometers (3.2 miles) from the release point. The accident evaluation assumes a hypothetical member of the public is located at this site boundary. As in the case of the noninvolved worker, the seriousness of the exposure of a member of the public located at the nearest site boundary is determined by comparing the concentration at that distance to the ERPG-2 and -3 levels of concern. Neither the noninvolved worker nor the hypothetical member of the public would be exposed to chemical concentrations exceeding levels of concern. The direction traveled by the chemical plume would depend upon meteorological conditions at the time of the accident.

Construction Accidents

New facility construction includes the risk of accidents that could impact workers. Because construction activities do not involve radioactive materials, there would be no radiological impacts. The presence of hazardous flammable, explosive, and other chemical substances could initiate accident conditions that could impact the health and safety of workers. In addition, in the course of their work, construction personnel and site personnel could receive serious or fatal injuries as a result of incidents that are in the category of industrial accidents. The occurrence of these incidents and their impacts cannot be meaningfully predicted. However, DOE and its construction contractors adhere to strict safety standards and procedures to provide a working environment that minimizes the possibility of accidents.

Table 4–23 Chemical Accident Impacts at Idaho National Laboratory Under the Consolidation Alternative

Chemical	Quantity Released (kilograms)	ERPG-2 [a]		ERPG-3 [b]		Concentration	
		Limit	Distance to Limit (meters)	Limit	Distance to Limit (meters)	Noninvolved Worker at 640 Meters	Nearest Site Boundary at 5.2 Kilometers
Nitric acid	984	6 ppm	128	78 ppm	21	0.33 ppm	0.013 ppm
Hydrochloric acid	146	20 ppm	232	150 ppm	80	2.85 ppm	0.037 ppm

ERPG = Emergency Response Planning Guideline, ppm = parts per million.

[a] ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (NOAA 2005).

[b] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (NOAA 2005).

Note: To convert from kilograms to pounds, multiply by 2.2046; from meters to yards, by 1.0936; from kilometers to miles, by 0.62137.

4.2.9.3 Transportation

Transportation impacts consist of impacts of incident-free or routine transportation and impacts of transportation accidents. Incident-free transportation impacts include radiological impacts on the public and workers from the radiation field surrounding the transportation package. Nonradiological impacts of potential transportation accidents include traffic accident fatalities. See Section D.5.2 for a discussion of the human health risks from pollutants emitted by transport vehicles.

The impact of a specific radiological accident is expressed in terms of probabilistic risk, which is defined as the accident probability (i.e., accident frequency) multiplied by the accident consequences. The overall risk is obtained by summing the individual risks from all reasonably conceivable accidents. The analysis of accident risks takes into account a spectrum of accidents ranging from high-probability accidents (fender bender) of low-consequence to high-consequence accidents that have a low probability of occurrence. The analysis approach and details on modeling and parameter selections are provided in Appendix D of this EIS.

Under this alternative, DOE would consolidate all activities related to RPS production at INL. DOE would use facilities at MFC for neptunium storage, target fabrication, post-irradiation target processing, plutonium purification, pelletization, and encapsulation, and RPS assembly and test operations. Target irradiation would occur at ATR. Transportation impacts of activities within INL would be very small and enveloped by the operational impacts associated with RPS production.

This alternative would also involve the transportation of existing available inventory of plutonium-238 inside milliwatt generator heat sources from dismantled nuclear weapons. The offsite transportation impacts under this alternative would include those resulting from intersite shipments of milliwatt generator heat sources between Pantex or LANL, and INL, from 2009 to 2022. This alternative would involve 28 intersite shipments of radioactive materials. The total distance traveled on public roads would be about 52,600 kilometers (32,690 miles).

Impacts of Incident-Free Transportation

The dose to transportation workers from all transportation activities under this alternative has been estimated to be about 0.77 person-rem, and the dose to the public would be about 0.43 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0.00046 LCFs among transportation workers and 0.00026 LCFs in the total affected population over the duration of transportation activities. LCFs associated with radiological releases were estimated by multiplying the occupational (worker) and public dose by 6.0×10^{-4} LCFs per person-rem of exposure.

Impacts of Accidents during Transportation

As stated earlier, two sets of analyses were performed for the evaluation of transportation accident impacts: impacts of maximum reasonably foreseeable severe accidents and impacts of all conceivable accidents (total transportation accidents).

The maximum reasonably foreseeable offsite transportation accident under this alternative (probability of occurrence: more than 1 in 10 million per year) would not breach the transportation package. The consequences of most-severe accidents that could breach the transportation package and its contents, releasing radioactive materials, were estimated to have a likelihood of less than 1 in 10 million per year.

As described in Appendix D, Section D.7 of this EIS, estimates of the total transportation accident risks under this alternative are as follows: a radiological dose to the population of 0.00021 person-rem, resulting in 1.25×10^{-7} LCFs, and traffic accidents resulting in 0 (0.00042) fatalities, based on 52,600 kilometers (32,690 miles) traveled.

4.2.9.4 Emergency Preparedness

During the production of plutonium-238 under the Consolidation Alternative, radioactive materials would be transported only within the boundaries of INL. Radioactive waste shipments would occur to offsite waste management facilities under all alternatives. Section 4.1.9.4 describes emergency preparedness measures that apply to the shipment of radioactive and hazardous waste.

4.2.10 Environmental Justice

Construction Impacts—There would be no disproportionately high and adverse environmental impacts on minority and low-income populations due to construction of RPS nuclear production facilities at MFC and the new road under this alternative. As stated in other subsections of Section 4.2, environmental impacts of construction would be small and are not expected to extend beyond the INL site boundary.

Operational Impacts—No disproportionately high and adverse environmental impacts on minority and low-income populations would occur under this alternative. This conclusion is a result of analyses presented in this EIS that determined there would be no significant impacts on human health or ecological, cultural, socioeconomic, or other resource areas described in other subsections of Section 4.2.

As discussed in Section 4.2.9.1, radiological and hazardous chemical risks to the public resulting from normal operations would be small. Routine normal operations at these facilities are not expected to cause fatalities or illness among the general population, including minority and low-income populations living within the potentially affected area.

Annual radiological risks to the offsite population that could result from accidents at these facilities are estimated to be less than 5.1×10^{-5} LCFs (see Section 4.2.9.2). Hence, the annual risks of an LCF in the entire offsite population resulting from an accident under the Consolidation Alternative would be less than 1 in 20,000.

Subsistence Consumption of Fish, Wildlife, and Game

Section 4–4 of Executive Order 12898 directs Federal agencies "whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence and that Federal governments communicate to the public the risks of these consumption patterns." In the *Idaho High-Level Waste and Facilities Disposition Final Environmental Impact Statement (Idaho HLW and Facilities Disposition EIS)*, DOE considered whether there were any means for minority and low-income populations to be disproportionately affected by examining levels of contaminants in crops, livestock, and game animals on or near INL (DOE 2002e).

Controlled hunting is permitted on INL land but is restricted to a very small portion of the northern half of INL. The hunts are intended to assist the Idaho Department of Fish and Game in reducing crop damage on private agricultural lands adjacent to INL. In addition to the limited hunting on INL, several game species and birds live on and migrate through INL. DOE routinely samples game species residing on INL, sheep that have grazed on INL, locally grown crops, and milk around INL for radionuclides. Concentrations of radionuclides in the samples have been small and are seldom higher than concentrations observed at control locations distant from INL. The principal source of non-natural radionuclides at these control locations is very small amounts of residual atmospheric fallout from past nuclear weapons tests. Data from programs monitoring these sources of food are reported annually in the *INEEL Site Environmental Report* (DOE 2002e).

Based on DOE monitoring results, concentrations of contaminants in crops, livestock, and game animals in areas surrounding INL are low, and seldom above background levels (DOE 2002e). Moreover, the impact analyses conducted for this EIS (see Section 4.2.6) indicate that native plants and wildlife in the ROI would not be harmed by the proposed consolidation of RPS nuclear production operations at INL. Consequently, no disproportionately high and adverse human health impacts are expected in minority or low-income populations in the region as a result of subsistence consumption of fish, wildlife, native plants, or crops.

4.2.11 Waste Management and Pollution Prevention

4.2.11.1 Waste Management

Construction and Operations Impacts—Major operational activities related to waste management include: target fabrication, target irradiation, post-irradiation processing, and purification, pelletization, and encapsulation. Other RPS production operations, such as storage of target material, transportation, and RPS assembly and testing, would generate essentially no or minimum waste.

During storage of neptunium-237 at INL, essentially no waste is expected to be generated. As storage of neptunium-237 under the Consolidation Alternative remains the same as under the No Action Alternative, there would be no additional impact on the environment (DOE 2000f).

For the transportation of special nuclear materials between sites at INL, the only anticipated waste associated with this activity would be from decontamination of the shipping containers used for the transportation. The minor amount of low-level radioactive waste is expected to be less than 0.29 cubic meters (0.37 cubic yards) per year (ORNL 2005, DOE 2000f).

No impact on waste management activities of RPS assembly and testing is anticipated. RPS cleaning operations would generate, on a nonroutine basis, very small volumes of liquid low-level radioactive waste and hazardous waste. The amounts of these wastes generated by RPS assembly and testing operations would be a small fraction of the existing MFC waste streams (DOE 2002c). No incremental impact on waste management is anticipated.

For target irradiation in ATR, only very small amounts of additional waste would be generated because the reactor would already be operating for other purposes. The incremental amount of this waste would be very small. About 1 cubic meter (1.3 cubic yards) per year of solid low-level radioactive waste would be generated (DOE 2000f). Therefore, target irradiation at ATR would result in a very small impact on waste management at INL.

Target fabrication and post-irradiation processing would be transferred from REDC at ORNL to a new facility at INL, the Plutonium-238 Facility at MFC. The waste management impact on the existing operation at REDC is small, as discussed in the *NI PEIS* (DOE 2000f). The Proposed Action is to transfer this small impact from REDC at ORNL to the new facility at INL. The data basis at the Fluorinel Dissolution Process and Fuel Storage Facility at INL was used to project the proposed new facility waste generation at INL (DOE 2000f). **Table 4–24** summarizes the estimated waste generation from target fabrication and post-irradiation processing under the Consolidation Alternative and compares it with sitewide waste generation at INL. Table 4–24 shows that the incremental impact on waste management at INL would generally be small.

Table 4–24 Estimated Target Fabrication and Post-irradiation Processing Waste Generation Compared to Idaho National Laboratory Sitewide Waste Generation Under the Consolidation Alternative

Waste Type [a]	*Annual Generation Rate (cubic meters, except as noted)*	*Fraction of 2004 Sitewide INL Generation (percent)*
Transuranic [b]	7	70
Liquid low-level radioactive	30	0.30
Solid low-level radioactive	35	0.36
Mixed low-level radioactive	5	0.36
Hazardous	6,500 kilograms	2.4
Nonhazardous process wastewater	23	0.14 of INL Percolation Pond
Nonhazardous sanitary wastewater	1,658	0.00052 of INL Sewage Treatment Plant Capacity
Nonhazardous solid	149	0.31 of Central Facility Landfill

INL = Idaho National Laboratory.

[a] See definitions in Section B.12.1.

[b] The transuranic waste would be disposed of at WIPP (LANL 2005). After WIPP closure in 2034, transuranic waste would be disposed of in a suitable geologic repository.

Note: To convert from cubic meters to cubic yards, multiply by 1.3079; from kilograms to pounds, by 2.2046.

Under the Consolidation Alternative, plutonium purification, pelletization, and encapsulation operations would be transferred from LANL to the proposed new Plutonium-238 Facility at MFC in 2011. Current waste generation data from the Plutonium Facility at LANL for nuclear operations in support of RPS production were used to estimate the additional waste generation at INL as well as LANL (from 2007 to 2011) (see Table 4–10). (LANL 2004d). **Table 4–25** summarizes the estimated waste generation from purification, pelletization, and encapsulation activities and compares it with sitewide waste generation at INL. Table 4–25 shows that the additional waste generated from plutonium purification, pelletization, and encapsulation would be small and the impact would generally be small. See **Table 4–26** and the accompanying text for a discussion of transuranic waste volumes.

Table 4–26 summarizes the estimated total waste generation from RPS production at INL under the Consolidation Alternative and compares it with the sitewide inventory/production. Table 4–26 also includes methods of disposition of these wastes. Table 4–26 shows that the impact on waste management under the Consolidation Alternative would be small, and the wastes generated would be disposed of in an acceptable manner approved by Federal agencies and the state.

Table 4–25 Estimated Plutonium Purification, Pelletization, and Encapsulation Waste Generation Compared to Idaho National Laboratory Sitewide Generation Under the Consolidation Alternative

Waste Type [a]	*Annual Generation Rate (cubic meters, except as noted)*	*Fraction of 2004 Sitewide INL Generation (percent)*
Transuranic [b]	13	130
Liquid low-level radioactive	133	1.4
Solid low-level radioactive	17	0.17
Mixed low-level radioactive	0.34	0.025
Hazardous [c]	<1 kilogram	< 0.3

INL = Idaho National Laboratory.
[a] See definitions in Section B.12.1.
[b] The transuranic waste would be disposed of at WIPP (LANL 2005).
[c] Hazardous wastes generated from all TA-55 operations, including plutonium-238 heat source production are insignificant.
Note: To convert from cubic meters to cubic yards, multiply by 1.3079.

Table 4–26 Estimated Radioisotope Power System Production Total Waste Generation Compared to Idaho National Laboratory Sitewide Generation and Waste Disposition for the Consolidation Alternative

Waste Type [a]	*Annual Generation Rate (cubic meters, except as noted)*	*Fraction of 2004 INL Generation*	*Waste Disposition*
Transuranic	20	200 percent [b]	Certify and dispose of at WIPP
Liquid low-level radioactive	163	1.7 percent	Grout, certify, and dispose of at NTS or commercially
Solid low-level radioactive	52	0.53 percent	Certify and dispose of at NTS or commercially
Mixed low-level radioactive	5.4	0.39 percent	Treat (as required), certify, and dispose of at NTS or commercially
Hazardous	6,500 kilograms [c]	2.4 percent	Dispose of commercially
Nonhazardous solid	149 [c]	0.31 percent of INL Central Facility Landfill	INL Central Facility Landfill
Nonhazardous process wastewater	23 [c]	0.14 percent of INL Percolation Pond	INL Percolation Pond
Nonhazardous sanitary wastewater	1,658 [c]	0.00052 percent of INL Sewage Treatment Plant capacity	INL Sewage Treatment Plant

INL = Idaho National Laboratory, WIPP = Waste Isolation Pilot Plant, NTS = Nevada Test Site.
[a] See definitions in Section B.12.1.
[b] The annual transuranic waste generation would be less than 0.04 percent of the 61,553 cubic meters (80,505 cubic yards) of transuranic waste in storage at INL or 1 percent over the 35-year project life.
[c] The quantity of wastes generated from plutonium purification, pelletization, and encapsulation operations is not included. These wastes are expected to be small. The incremental impact at INL would be small as all of these wastes would be disposed of by using acceptable methods.
Note: To convert from cubic meters to cubic yards, multiply by 1.3079; from kilograms to pounds, by 2.2046.

As shown in Table 4–26, total transuranic waste generation at the new Plutonium-238 Facility would be 95 percent of INL transuranic waste generation for 2004. Because transuranic waste would be certified for shipment to WIPP at the new Plutonium-238 Facility, and it would be less than 0.2 percent of the 11,140 cubic meters (14,570 cubic yards) of transuranic waste in storage at INL annually (6 percent over 35 years), minimal impacts to the transuranic waste management infrastructure at INL would be expected. If this waste is determined to be mixed transuranic waste, the treatment of this waste would be integrated into the Idaho Site Treatment Plan and Consent Order for Federal Facility Compliance Plan. The generation of this waste would not impact the plan for accelerating the Cleanup of the Idaho National Engineering and Environmental Laboratory because the waste would be disposed of off site after treatment.

4.2.11.2 Waste Minimization and Pollution Prevention

DOE Idaho Operations Office has an active waste minimization and pollution prevention program to reduce the total amount of waste generated and disposed of at INL. This is accomplished by eliminating waste through source reduction or material substitution; recycling potential waste materials that cannot be minimized or eliminated; and treating all waste that is generated to reduce its volume, toxicity, or mobility prior to storage or disposal. The Idaho Operations Office published its first Waste Minimization Plan in 1990, which defined specific goals, methodologies, responsibilities, and achievements of programs and organizations.

INL now promotes the incorporation of pollution prevention into all planning activities, and that pollution prevention is integral to mission accomplishment. In 2002, INL reported 38 pollution prevention projects, which resulted in a waste reduction of 13,906 metric tons. Examples of pollution prevention projects at INL include the fabrication of lead bricks from over 90,720 kilograms (200,000 pounds) of radioactively contaminated lead taken from dismantled casks and shielding, which were reused/recycled by the Idaho State University Accelerator Center; and the sale of a variety of items, including desks, chairs, used tires, scrap metal, and computer components, to the public.

4.2.12 Environmental Restoration Program

Construction Impacts—Prior to commencing ground disturbance related to new facility and new road construction, DOE would survey potentially affected areas to ensure that no contaminated media would be disturbed. If contaminated media are detected, DOE would determine the extent and nature of any contamination and require remediation in accordance with procedures established under the site's Environmental Restoration Program and in accordance with applicable RCRA and CERCLA regulations and consent agreements.

Operations Impacts— The consolidation of RPS nuclear production operations at MFC is not expected to affect the Environmental Restoration Program at INL. The Plutonium Facility at LANL would continue to be used for other purposes and would not be decommissioned after the cessation of the RPS mission.

4.3 Consolidation with Bridge Alternative

A detailed description of the Consolidation with Bridge Alternative is presented in Section 2.2.3 of this EIS.

Information on impacts from the operation of the FMF storage facility and ATR at INL, and HFIR and REDC at ORNL, were compiled from the *NI PEIS* (DOE 2000f). The impacts of Assembly and Testing Facility operation at INL are based on the *FONSI and Mound EA* (DOE 2002c). Information on impacts of continued operation of the purification, pelletization, and encapsulation functions at the Plutonium Facility at LANL is largely from the *Environmental Assessment for Radioisotope Heat Source Fuel Processing and Fabrication* (DOE 1991). Information on impacts of construction and operation of the new RPS nuclear production facilities at MFC at INL is based on the *Consolidation EIS* information document (INL 2005c). Under this alternative, the Plutonium Facility at LANL would continue to support RPS nuclear production operations until 2011 when the new Plutonium-238 Facility becomes operational. The impacts from purification, pelletization, and encapsulation operations would be the same as described under the No Action Alternative. After 2011, these operations would be conducted at the new Plutonium-238 Facility at INL.

4.3.1 Land Resources

4.3.1.1 Land Use

Construction and Operations Impacts—Impacts on land use at INL under this alternative would be the same as those addressed in Section 4.2.1.1 for the Consolidation Alternative.

All activities during the bridge period would take place within existing facilities. There would be no change or effect on land use at ORNL and LANL, because no additional land would be disturbed, and the use of existing facilities would be compatible with their present missions.

4.3.1.2 Visual Environment

Construction and Operations Impacts—Impacts on visual resources at INL under this alternative would be the same as those addressed for the Consolidation Alternative in Section 4.2.1.2.

All activities during the bridge period would take place within existing facilities. There would be no impact on visual resources since the current Visual Resource Management Class IV rating would not change.

4.3.2 Site Infrastructure

Construction Impacts—Under the Consolidation with Bridge Alternative, REDC at ORNL would be modified internally to fabricate and process irradiated targets. Because modification work would take place within an existing operational facility, no incremental impact on utility infrastructure demands is expected. Impacts on the local transportation network would also be negligible. The impacts on utility infrastructure requirements of new facility construction at INL would be the same as those described in Section 4.2.2.

Operations Impacts—Utility requirements of the modified REDC, while in operation, are not expected to vary substantially from those analyzed under the No Action Alternative (see Section 4.1.2). Subsequently, impacts on utility infrastructure requirements of new facility operations at INL would be the same as those described in Section 4.2.2.

4.3.3 Geology and Soils

Construction Impacts—Facility modifications at REDC would be confined to the interior of existing facilities. Therefore, there would be no disturbance to either geologic or soil resources. As detailed in Section 4.1.3, hazards from large-scale geologic conditions at ORNL present a low risk to facilities such as REDC. Further, DOE Order 420.1A requires that nuclear and nonnuclear facilities be designed, constructed, and operated so that the public, workers, and environment are protected from the adverse impacts of natural phenomena hazards, including earthquakes. The order stipulates natural phenomena hazards mitigation requirements for DOE facilities and specifically provides for reevaluation and upgrade of existing DOE facilities when there is a significant degradation in the safety basis for the facility. Subsequently, impacts on geologic and soil resources of new facility construction at INL would be the same as those described in Section 4.2.3.

Operations Impacts—Operations of the modified REDC under this alternative are expected to have minimal impacts on geologic and soil resources at ORNL. Subsequently, minimal impacts on geologic and soil resources of new facility operations at INL would be expected, and risks to new facilities from large-scale geologic hazards are expected to be low, as described in Section 4.2.3.

4.3.4 Water Resources

4.3.4.1 Surface Water

Construction Impacts—Facility modifications at REDC would be confined to the interior of existing facilities and would therefore have no impact on surface water resources. No incremental impact on utility infrastructure demands (see Section 4.3.2), including surface water use, is expected. In addition, there would be no measurable increase in wastewater generation associated with facility modifications. Subsequently, impacts on surface water resources of new facility construction at INL would be the same as those described in Section 4.2.4.

Operations Impacts—Operations of the modified REDC under this alternative would not have any measurable impact on effluent quantity or quality at ORNL, and no incremental impact on surface water. Subsequently, impacts on surface water resources of new facility operations at INL would be the same as those described in Section 4.2.4.

4.3.4.2 Groundwater

Construction Impacts—Facility modifications at REDC would be confined to the interior of existing facilities and would therefore have no impact on groundwater resources. No incremental impact on utility infrastructure demands (see Section 4.3.2), including groundwater use, is expected. Subsequently, impacts on groundwater resources of new facility construction at INL would be the same as those described in Section 4.2.4.

Operations Impacts—Operations of the modified REDC under this alternative would not have any measurable impact on effluent quantity or quality at ORNL, and no incremental impact on groundwater resources. Subsequently, impacts on groundwater resources of new facility operations at INL would be the same as those described in Section 4.2.4.

4.3.5 Air Quality and Noise

4.3.5.1 Air Quality

Nonradiological Releases

Construction and Operations Impacts—Nonradiological air quality impacts at INL under the Consolidation with Bridge Alternative would be the same as those under the Consolidation Alternative, described in Section 4.2.5.1.

Nonradiological air quality impacts at ORNL under the Consolidation with Bridge Alternative would be similar to those under the No Action Alternative, described in Section 4.1.5.1, except that operations would end after 5 years.

Under this alternative, operation of the Plutonium Facility at LANL for purification, pelletization, and encapsulation would result in nonradiological air quality impacts similar to the No Action Alternative as described in Section 4.1.5.1. These impacts would result from operation of the boilers for facility heating. Operations in the Plutonium Facility at TA-55 would not result in the boilers exceeding their permitted levels of emissions. Impacts would be similar to those under the No Action Alternative.

Air pollutant emissions from operations under this alternative would be small and not subject to PSD regulations. Therefore, a PSD increment analysis is not required (see Section B.4.1).

The Final Rule for "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" requires a conformity determination for certain-sized projects in nonattainment areas. DOE has performed a review for this alternative and concluded that a conformity determination is not necessary to meet the requirements of the Final Rule, because INL, ORNL, and LANL are located in attainment areas for all criteria pollutants, except for ozone and $PM_{2.5}$ (particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers) at ORNL, and threshold emission levels would not be exceeded by the activities considered (DOE 2000a). See Section D.5.2 for a discussion of the human health risks from pollutants emitted by transport vehicles.

Radiological Releases

Construction Impacts—While no radiological releases to the environment are expected in association with RPS consolidation construction activities at MFC, the potential exists for contaminated soils and possibly other media to be disturbed during excavation and other site activities. Prior to commencing ground disturbance, DOE would survey potentially affected areas to determine the extent and nature of contamination and would be required to clean-up contamination in accordance with procedures established under INL's Environmental Restoration Program and INL's Hazardous Waste Facility Permit.

Operations Impacts—Radioactive releases associated with storage of neptunium-237 at FMF would be essentially zero, as the canisters containing the neptunium-237 would remain in containment vessels during storage. Should plutonium-238 be required prior to completion of the RPS nuclear production facilities at MFC, an estimated 6.8×10^{-8} curies per year of plutonium-238 could be released to the environment during target fabrication and post-irradiation processing operations at REDC if the Consolidation with Bridge Alternative is implemented (see Section C.2.1.4). In addition, an estimated 1.0×10^{-8} curies per year of plutonium-238 could be released to the environment from purification, pelletization, and encapsulation operations at LANL's Plutonium Facility. Once operational, an estimated 1.7×10^{-7} curies per year of plutonium-238 from target fabrication and post-irradiation processing operations and 1.0×10^{-8} curies per year of plutonium-238 from purification, pelletization, and encapsulation operations could be released to the environment from the new Plutonium-238 Facility at MFC (see Section C.2.1.4). There would be no incremental releases to the environment from ATR and HFIR during target irradiation, because there would be no increase in activities in those reactors due to additional target irradiation. No releases are expected from the RPS Assembly and Testing Facility at MFC, because the facility would handle only fully encapsulated radioactive material. There would be no other types of radiological releases from RPS nuclear production operations. Impacts of radiological releases are discussed in Section 4.3.9.

4.3.5.2 Noise

Construction and Operations Impacts—Noise impacts at INL under the Consolidation with Bridge Alternative are expected to be the same as those under the Consolidation Alternative, described in Section 4.2.5.2.

Noise impacts at ORNL under the Consolidation with Bridge Alternative would be similar to those under the No Action Alternative, described in Section 4.1.5.2, except that operations would end after 5 years.

Under this alternative, operation of the Plutonium Facility at LANL for purification, pelletization, and encapsulation of plutonium-238 would result in noise impacts similar to those under the No Action Alternative, described in Section 4.1.5.2. Onsite noise impacts are expected to be minimal, and offsite noise levels would not be noticeable. Traffic associated with plutonium-238 purification, pelletization, and encapsulation in the Plutonium Facility at LANL would be minor and would not lead to noticeable noise levels either on or offsite. Impacts would be similar to those under the No Action Alternative.

4.3.6 Ecological Resources

Construction Impacts— No new construction would occur under the Consolidation with Bridge Alternative at REDC at ORNL and the Plutonium Facility at LANL. There would be no direct disturbance to ecological resources, including threatened and endangered species, or loud noises that would adversely impact wildlife at these sites. Also, wetlands and aquatic resources would not be affected as water use and wastewater discharge would either not occur or would be minimal.

Construction impacts at INL under the Consolidation with Bridge Alternative would be the same as those under the Consolidation Alternative, described in Section 4.2.6. Ecological impacts from the construction of the Radiological Welding Laboratory would be minimal, as it would be located within a highly developed portion of MFC. Also, impacts on ecological resources from the construction of the Plutonium-238 Facility at MFC and new road connecting MFC and ATR would be as described in Section 4.2.6.

Operations Impacts—Measurable impacts on populations of plants and animals on or off DOE sites are not expected as a result of the incremental increase in exposure to radionuclides or chemicals that could result from operation of facilities under this alternative. DOE routinely samples game species residing on or near the sites, livestock in the region, locally grown crops, and milk for radionuclides. The results of this monitoring are reported in the annual environmental reports prepared for each site. Concentrations of radionuclides in the plant and animal samples are generally small and are seldom higher than concentrations observed at control locations distant from the sites. Additional deposition resulting from implementation of this alternative is not expected to lead to levels of contaminants that would exceed the historically reported ranges of concentrations. Therefore, DOE anticipates minimal impacts on the ecology of the DOE sites, and on plant and animal populations, as a result of exposure to radionuclides or chemicals under this alternative.

4.3.7 Cultural Resources

Construction and Operations Impacts—Under the Consolidation with Bridge Alternative, construction of new facilities, the Plutonium-238 Facility at MFC, Support Building, Radiological Welding Laboratory, and a new road between ATR and MFC are proposed at INL. Potential impacts on cultural resources, described in Section 4.2.7 would be the same under the Consolidation with Bridge Alternative as under the Consolidation Alternative.

The existing facilities, described for the No Action Alternative, would be used until the new consolidated RPS nuclear production facilities at MFC are ready for operation. As described for the No Action Alternative in Section 4.1.7, as no external modifications to existing buildings, new construction, or land disturbances are planned under the Consolidation with Bridge Alternative, no impacts on cultural resources are expected.

4.3.8 Socioeconomics

Construction Impacts—Modifications to existing MFC facilities at INL and construction of the new buildings and road would require a peak construction employment level of 245 workers (INL 2005c). This level of employment would generate about 237 indirect jobs in the region around INL. The potential total employment increase of 482 direct and indirect jobs represents an approximate 0.4 percent increase in the workforce and would occur only during the 22 months of construction. It would have little to no noticeable impact on the socioeconomic conditions of the ROI. Since the employment requirements in support of construction at INL would be relatively small, the increase in traffic volume would also be small and not likely to be noticed by commuters in the vicinity of INL.

Operations Impacts—The consolidation of RPS nuclear production operations at MFC could result in the permanent relocation or hiring of approximately 75 new employees (INL 2005c). This level of employment would generate about 72 indirect jobs in the region around INL. The potential total employment increase of

147 direct and indirect jobs represents an approximate 0.1 percent increase in the workforce. The increase in the number of workers in support of consolidated RPS nuclear operations would have little or no noticeable impact on socioeconomic conditions in the INL ROI. Workers assigned to the new RPS nuclear production facilities at MFC would be drawn for the most part from the existing INL workforce. The contributory effect of the remaining new employment, in combination with potential effects of other industrial and economic sectors within the regional economic area, would serve to reduce or mask any effect on the regional economy. New MFC employees hired to support the production of RPSs would compose a small fraction of the INL workforce (8,100 in 2001) and an even smaller fraction of the regional workforce (more than 92,000 in 1999).

Target fabrication and post-irradiation processing of targets at ORNL's REDC during the bridge period would require up to 41 workers. This level of employment was estimated to generate approximately 105 additional jobs in the region around ORNL. Assuming these are new jobs to the region, the potential increase of 146 jobs would represent a less than 0.1 percent increase in the workforce. An increase in employment of this size and other related economic activity in support of RPS nuclear operations at ORNL would have no noticeable impact on socioeconomic conditions in the Oak Ridge Reservation ROI (DOE 2000f).

There would be no impact on socioeconomic conditions in the LANL region during the bridge period, because operations at the Plutonium Facility are ongoing and continue to utilize nondedicated workers.

Since the employment requirements in support of consolidated RPS nuclear production operations at INL would be small, the increase in traffic volume at INL from RPS nuclear production at MFC would also be small and not likely to be noticed by commuters in the vicinity of INL. Employment in support of RPS nuclear production operations at LANL during the bridge period would not change; therefore, traffic volumes at LANL also would not change. The increase in traffic volume at ORNL from RPS nuclear production at REDC during the bridge period would be small and not likely to be noticed by commuters in the vicinity of ORNL.

At the end of the bridge period, nuclear operations in support of RPS production at REDC at ORNL and at the Plutonium Facility at LANL would cease. As described in Section 4.2.8, cessation of nuclear operations at ORNL and LANL would have minimal impacts on site workforces and regional economies. Section 4.1.8 states that no noticeable impact on socioeconomic conditions in the ORNL ROI would occur during operations under the No Action Alternative. Likewise, there would be no impacts on socioeconomic conditions in the ORNL region from discontinuing these operations. RPS related operations at the Plutonium Facility at LANL currently employ a small number of nondedicated workers. Therefore, there would be no impact on socioeconomic conditions in the LANL region since these workers would continue to be employed handling other radioactive materials.

4.3.9 Public and Occupational Health and Safety

Assessments of radiological and chemical impacts associated with the Consolidation with Bridge Alternative are presented in this section. Supplemental information is provided in Appendix C of this EIS.

4.3.9.1 Construction and Normal Operations

No routine radiological or hazardous chemical releases are expected during construction activities. During normal operations, there could be incremental radiological and hazardous chemical releases to the environment and also incremental direct in-plant exposures. The resulting doses and potential health effects to the public and workers under this alternative are described below. They are divided into two periods; the bridge period (2007 to 2011) and the period when all activities are consolidated at INL (2012 to 2047).

Radiological Impacts

Incremental radiological doses to three receptor groups from operations at INL, ORNL, and LANL are given in **Table 4–27** for the period 2007 to 2011 and **Table 4–28** for the period 2012 to 2047. The tables provide doses to the population within 80 kilometers (50 miles), the MEI, and the average exposed member of the public. The projected number of excess LCFs in the surrounding population and the excess LCF risk to the MEI and average exposed individual are also presented in the tables. The surrounding population for the period 2001 to 2011 is that projected for the year 2010. The surrounding population for the period 2012 to 2047 is that projected for the year 2050. A probability coefficient of 6×10^{-4} LCF per rem is applied for the public and workers.

Table 4–27 Incremental Radiological Impacts on the Public from Operation of Facilities Under the Consolidation with Bridge Alternative (2007 to 2011)

Receptor	*INL*		*ORNL*		*LANL Plutonium Facility*
	MFC [a]	*ATR* [b]	*HFIR* [b]	*REDC*	
Population within 80 kilometers (50 miles) in the year 2010					
Dose (person-rem)	1.2×10^{-6}	No change	No change	4.8×10^{-5}	1.8×10^{-5}
5-year period excess latent cancer fatalities	3.5×10^{-9}	No change	No change	1.4×10^{-7}	5.4×10^{-8}
Maximally exposed individual					
Annual dose (millirem)	1.4×10^{-7}	No change	No change	1.8×10^{-6}	1.0×10^{-6}
5-year excess latent cancer fatality risk	4.2×10^{-13}	No change	No change	5.4×10^{-12}	3.0×10^{-12}
Average exposed individual within 80 kilometers (50 miles)					
Annual dose [c] (millirem)	4.7×10^{-9}	No change	No change	4.2×10^{-8}	3.0×10^{-8}
5-year excess latent cancer fatality risk	1.4×10^{-14}	No change	No change	1.3×10^{-13}	9.0×10^{-14}

INL = Idaho National Laboratory, ORNL = Oak Ridge National Laboratory, LANL = Los Alamos National Laboratory, MFC = Materials and Fuels Complex, ATR = Advanced Test Reactor, HFIR = High Flux Isotope Reactor, REDC = Radiochemical Engineering Development Center.

[a] Because exposure data are not available for neptunium-237 storage exclusively, values are conservatively estimated to be 10 percent (DOE 2000f) of the fabrication and processing component of the total neptunium-237 target fabrication, processing, and storage doses at REDC. These values serve as an upper-bound representation of the potential impacts that could be incurred from neptunium-237 storage.

[b] There would be no incremental radiological impacts of operation of ATR or HFIR because the insertion of targets does not affect reactor operating conditions or contribute a new source of radiological emissions.

[c] Obtained by dividing the population dose by the number of people projected to live within 80 kilometers (50 miles) of the site in the year 2010 (ATR at INL = 118,800; MFC at INL = 245,000; ORNL = 1,129,000; LANL = 357,400).

With respect to Table 4–27, doses at INL would be attributed to storage of the neptunium-237 targets. Assembly and test activities would also be performed at the Assembly and Testing Facility at MFC during the bridge period. However, Assembly and Testing Facility operations are not expected to release any radioactivity on or offsite because the facility would handle only fully encapsulated radioactive material. Doses at ORNL would be attributed to target fabrication and post-irradiation processing at REDC. Doses at LANL are attributed to the purification, pelletization, and encapsulation activities at the Plutonium Facility at TA-55.

During the bridge period, the highest population dose, MEI dose, and average exposed individual dose would occur at ORNL from activities at REDC. The annual population dose at ORNL would be 4.8×10^{-5} person-rem, with a 5-year excess LCF risk of 1.4×10^{-7}. The annual MEI dose would be 1.8×10^{-6} millirem, within a 5-year excess LCF risk of 5.4×10^{-12}. The annual average exposed individual dose would be 4.2×10^{-8} millirem, with an excess LCF risk of 1.3×10^{-13}.

Table 4–28 Incremental Radiological Impacts on the Public from Operation of Facilities at Idaho National Laboratory Under the Consolidation with Bridge Alternative (2012 to 2047)

Receptor	*INL*	
	MFC	*ATR* [a]
Population within 80 kilometers (50 miles) in the year 2050		
Dose (person-rem)	1.9×10^{-5}	No change
5-year period excess latent cancer fatalities	4.1×10^{-7}	No change
Maximally exposed individual		
Annual dose (millirem)	1.6×10^{-6}	No change
35-year excess latent cancer fatality risk	3.4×10^{-11}	No change
Average exposed individual within 80 kilometers (50 miles)		
Annual dose [b] (millirem)	5.4×10^{-8}	No change
5-year excess latent cancer fatality risk	1.1×10^{-12}	No change

INL = Idaho National Laboratory, MFC = Materials and Fuels Complex, ATR = Advanced Test Reactor.

[a] There would be no incremental radiological impacts of operation of ATR or HFIR because the insertion of targets does not affect reactor operating conditions or contribute a new source of radiological emissions.

[b] Obtained by dividing the population dose by the number of people projected to live within 80 kilometers (50 miles) of the site in the year 2050 (ATR at INL = 172,200; MFC at INL = 355,000).

There would be no incremental dose to the MEI from HFIR operations because there would be no increase in radiological releases to the environment from the reactor under this alternative.

With respect to Table 4–28, doses at INL would be attributed to all RPS production activities performed at MFC. This includes storage of target materials at FMF; fabrication and post-irradiation processing at the Plutonium-238 Facility at MFC; purification, pelletization, and encapsulation activities at the Plutonium-238 Facility at MFC and assembly and test operations at the Assembly and Testing Facility.

During the bridge period 2012 to 2047, the annual population dose at INL would be 1.9×10^{-5} person-rem, with a 35-year LCF risk of 4.1×10^{-7}. The annual MEI dose would be 1.6×10^{-6} millirem, with a 35-year excess LCF risk of 3.4×10^{-11}. The annual average exposed individual dose would be 5.4×10^{-8} millirem, with an excess LCF risk of 1.1×10^{-12}.

There would be no incremental dose to the MEI from annual ATR operations because there would be no increase in radiological releases to the environment from either of these reactors under this alternative.

Doses to involved workers from normal operations are given in **Table 4–29** for the period 2007 to 2011 and **Table 4–30** for the period 2012 to 2047. These workers are defined as those directly associated with process activities. The incremental annual average dose to workers at ATR at INL and HFIR at ORNL would be negligible; approximately 170 millirem to REDC workers (DOE 2000f), 17 millirem to MFC workers and 240 millirem to Plutonium Facility at TA-55 workers (LANL 2005). Doses to individual workers would be kept to minimal levels by instituting badged monitoring and ALARA programs.

Doses at INL would be attributed to all RPS production activities performed at MFC. This includes storage of target materials at FMF; fabrication and post-irradiation processing at the Plutonium-238 Facility at MFC, purification, pelletization, and encapsulation activities at the Plutonium-238 Facility at MFC; and assembly and test operations at the Assembly and Testing Facility.

Table 4–29 Incremental Radiological Impacts on Involved Workers from Operation of Facilities Under the Consolidation with Bridge Alternative (2007 to 2011)

Receptor–Involved Workers [a]	*INL*		*ORNL*		*LANL Plutonium Facility*
	MFC	*ATR* [b]	*HFIR* [b]	*REDC*	
Total dose (person-rem per year)	1.2 [c]	No change	No change	12 [d]	19 [e]
5-year period excess latent cancer fatalities	3.6×10^{-3}	No change	No change	3.6×10^{-2}	5.7×10^{-2}
Average worker dose (millirem per year)	17	No change	No change	170	240 [e]
5-year excess latent cancer fatality risk	5.1×10^{-5}	No change	No change	5.1×10^{-4}	7.2×10^{-4}

INL = Idaho National Laboratory, ORNL = Oak Ridge National Laboratory, LANL = Los Alamos National Laboratory, MFC = Materials and Fuels Complex, ATR = Advanced Test Reactor, HFIR = High Flux Isotope Reactor, REDC = Radiochemical Engineering Development Center.

[a] The radiological limit for an individual worker is 5,000 millirem per year (10 CFR 835). However, the maximum dose to a worker involved with operations would be kept below the DOE Administrative Control Level of 2,000 millirem per year (DOE 1999e). Further, DOE recommends that facilities adopt a more limiting, 500-millirem-per-year, Administrative Control Level (DOE 1999e). To reduce doses to ALARA levels, an effective ALARA program would be enforced.

[b] There would be no incremental radiological impacts of operation of ATR or HFIR because the insertion of targets does not affect reactor operating conditions or contribute a new source of radiological emissions.

[c] Because exposure data are not available for neptunium-237 storage exclusively, values are conservatively estimated to be 10 percent (DOE 2000f) of the total dose from neptunium-237 target fabrication/processing and neptunium-237 storage, and serve as an upper-bound representation of the potential impacts that could be incurred from neptunium-237 storage.

[d] Based on an estimated 75 badged workers.

[e] Based on an estimated 79 badged workers and an average of 0.24 rem per worker average at LANL (LANL 2005).

Table 4–30 Incremental Radiological Impacts on Involved Workers from Operation of Facilities Under the Consolidation with Bridge Alternative (2012 to 2047)

Receptor–Involved Workers [a]	*INL*	
	MFC	*ATR* [b]
Total dose (person-rem per year)	32	No change
35-year period excess latent cancer fatalities	0.68	No change
Average worker dose (rem per year)	0.49[c]	No change
35-year excess latent cancer fatality risk	0.013	No change

INL = Idaho National Laboratory, MFC = Materials and Fuels Complex, ATR = Advanced Test Reactor.

[a] The radiological limit for an individual worker is 5,000 millirem per year (10 CFR 835). However, the maximum dose to a worker involved with operations would be kept below the DOE Administrative Control Level of 2,000 millirem per year (DOE 1999e). Further, DOE recommends that facilities adopt a more limiting, 500-millirem-per-year, Administrative Control Level (DOE 1999e). To reduce doses to ALARA levels, an effective ALARA program would be enforced.

[b] There would be no incremental radiological impacts of operation of ATR or HFIR because the insertion of targets does not affect reactor operating conditions or contribute a new source of radiological emissions.

[c] Based on an estimated 65 badged workers (INL 2005c).

Hazardous Chemical Impacts

Carcinogenic and noncarcinogenic health effects of exposure to hazardous chemicals emitted from operations in REDC at ORNL were evaluated and reported in the *NI PEIS* (DOE 2000f). The hazardous chemical health effects for the bridge period 2007 to 2011 are summarized in **Table 4–31**.

The Hazard Index for activities at ORNL is estimated to be much less than 1 (0.006), and the cancer risk to be less than 1 in 1 million. Therefore, no chemical health effects are anticipated under the Consolidation with Bridge Alternative (2007 to 2011).

Nonradioactive air emissions from activities at the Plutonium Facility at LANL, would be mainly from the glovebox atmospheric gases argon and helium. These are inert and nonhazardous. Ethanol, used as a solvent at LANL, is likewise not hazardous. Vapors of hydrofluoric and nitric acids, used in decontamination, would be emitted at rates well below threshold values (DOE 1991).

Table 4–31 Incremental Hazardous Chemical Impacts on the Public around Oak Ridge National Laboratory Under the Consolidation with Bridge Alternative (2007 to 2011)

Chemical	*Modeled Annual Increment (milligrams per cubic meter)*	*RfC - Inhalation (milligrams per cubic meter)*	*Unit Cancer Risk (risk per milligram per cubic meter)*	*Hazard Quotient*	*Cancer Risk*
REDC at ORNL					
Diethyl benzene	3.37×10^{-5}	1	7.8×10^{-3}	3.37×10^{-5}	2.63×10^{-7}
Methanol	1.23×10^{-6}	1.75	NA	7.03×10^{-7}	NA
Nitric acid	1.53×10^{-6}	0.123	NA	1.25×10^{-5}	NA
Tributyl phosphate	6.34×10^{-5}	0.01	NA	6.34×10^{-3}	NA
			Hazard Index =	6.39×10^{-3}	

RfC = reference concentration, NA = not applicable (the chemical is not a known carcinogen or it is a carcinogen and only unit risk will apply).

Note: For diethyl benzene, the RfC for ethyl benzene and the unit cancer risk for benzene were used to estimate Hazard Quotient and cancer risk because no information was available for diethyl benzene. For tributyl phosphate, the RfC for phosphoric acid was used to estimate the Hazard Quotient because no information was available for tributyl phosphate.

Source: DOE 2000f.

For the period 2012 to 2047, hazardous chemical impacts at INL would be unchanged from baseline site operations because no new chemicals would be emitted to the air from storage of neptunium-237 in FMF at MFC or continued operation of ATR (DOE 2000f).

Impacts of hazardous chemical emissions due to target fabrication; post-irradiation processing; and purification, pelletization, and encapsulation operations are expected to be less than those reported for REDC at ORNL and the Plutonium Facility at LANL during the bridge period because of the new, modern facilities at MFC and the longer distance to a public receptor compared to REDC or the Plutonium Facility at LANL. Therefore, no chemical health effects are anticipated under the Consolidation with Bridge Alternative (2012 to 2047).

4.3.9.2 Facility Accidents

This section discusses potential accident impacts under the Consolidation with Bridge Alternative. Under accident conditions, there could be impacts at INL associated with storage of neptunium-237 in the FMF storage vault; target fabrication, post-irradiation processing, and plutonium-238 purification, pelletization, and encapsulation in the new facility to be constructed; assembly and test operations in the Assembly and Testing Facility; and target irradiation in ATR at INL. Under the bridge period of this alternative, irradiation would take place at HFIR at ORNL; REDC at ORNL would fabricate and process targets; and the Plutonium Facility at LANL would be used for plutonium-238 purification, pelletization, and encapsulation. The accident scenarios chosen for analysis have impacts that bound the suite of accidents that have occurred, and could occur, at the facilities. The selection of accident scenarios described in Appendix C of this EIS included the review of accident history as presented in Sections 3.2.9.4, 3.3.9.4, and 3.4.9.4. The accident scenarios that were analyzed result in higher public and noninvolved worker risks than historic accidents.

Incremental radiological doses to three receptor groups from postulated accidents at INL, ORNL, and LANL are estimated: the population within 80 kilometers (50 miles), the MEI of the public, and the noninvolved worker. The projected number of excess LCFs in the surrounding population and the excess LCF risk to the MEI and noninvolved worker are also presented. A probability coefficient of 6×10^{-4} LCFs per rem is applied for the public and workers.

Radiological Impacts

The sealed design of the plutonium-238 heat sources, which will be shipped from Pantex and LANL to INL, is not expected to cause any radiological risks from credible accidents. Potential impacts of neptunium-237 storage and target irradiation accidents under the Consolidation with Bridge Alternative have been evaluated by DOE in previous NEPA documents (DOE 2000f, 2002c).

Neptunium-237 Storage—Neptunium-237 would be stored in the FMF vault at INL. While the postulated beyond-design-basis earthquake may cause portions of the facility to collapse, the storage cans would not be stressed to a level that would breach the double containment of the can design (DOE 2000f).

Target Irradiation—For HFIR target irradiation accidents, the 5-year increased risk of an LCF to the offsite MEI and a noninvolved worker associated with plutonium-238 production would be 1.40×10^{-9} and 7.3×10^{-9}, respectively. The 5-year accident risk in terms of the increased number of LCFs in the offsite population would be 6.0×10^{-6} (DOE 2000f).

For ATR target irradiation accidents, the 35-year increased risk of an LCF to the offsite MEI and a noninvolved worker associated with plutonium-238 production would be 1.8×10^{-7} and 2.9×10^{-6}, respectively. The 35-year accident risk in terms of the increased number of LCFs in the offsite population would be 7.0×10^{-4} (DOE 2000f).

Assembly and Test Operations—A range of accidents were considered for Assembly and Testing Facility, including welding fire accidents, catastrophic failure of one or more of the fuel elements, and the potential for a wind-driven missile to penetrate a facility wall and glovebox. However, because of the solid ceramic form of the plutonium and the multiple protective features of the Category 3 building, any release to the environment from these accidents would be negligible. Any adverse effects would be mitigated by air filtration systems, room and building barriers, and air locks that contain releases (DOE 2002c). Because the probability of occurrence and release of radioactive materials outside of the building for these accidents was estimated to be less than 1 in 1 million per year, the risks to noninvolved workers and the public were not considered further.

Target Fabrication and Post-irradiation Processing—The consequences and risks of target processing accidents are shown in **Table 4–32**. Four potential accidents were postulated:

- A neptunium-237 target preparation ion exchange explosion. The estimated frequency of this accident is 1.0×10^{-2} per year.
- A plutonium-238 separation tank failure. The estimated frequency of this accident is 1×10^{-2} per year.
- An explosion of a plutonium-238 ion exchange column. The estimated frequency of this accident is 1.0×10^{-2} per year.
- A beyond-evaluation-basis earthquake, resulting in a collapse of the nearby stack and failure of the HEPA filter system intended to mitigate the consequences of releases. The estimated frequency of this accident is 1.0×10^{-5} per year.

The risks of the postulated accidents are shown in **Table 4–33**. The accident with the highest risk for the first 5-year period at REDC of the Consolidation with Bridge Alternative and for the next 35-year period at INL is a beyond-evaluation-basis earthquake. In the first 5 years, if this accident were to occur, the risk of an LCF would be 3.2×10^{-6} and 6.0×10^{-5} for the MEI and noninvolved worker, respectively; for the next 35 years, the risk would be 1.8×10^{-6} and 8.1×10^{-5}, respectively. The first 5-year period risk for the offsite population at REDC would be 8.5×10^{-4}; next 35-year period risk for the offsite population at INL would be 8.4×10^{-4}.

Table 4–32 Target Processing Annual Accident Consequences Under the Consolidation with Bridge Alternative

Accident	Maximally Exposed Individual		Population to 80 Kilometers (50 miles)		Noninvolved Worker	
	Dose (rem)	Latent Cancer Fatality [a]	Dose (person-rem)	Latent Cancer Fatalities [b]	Dose (rem)	Latent Cancer Fatality [a]
Neptunium-237 target preparation ion exchange explosion at INL	5.2×10^{-9}	3.1×10^{-12}	7.9×10^{-7}	4.8×10^{-10}	7.2×10^{-8}	4.3×10^{-11}
Plutonium-238 separation tank failure at INL	1.3×10^{-7}	7.5×10^{-11}	2.8×10^{-5}	1.7×10^{-8}	1.9×10^{-6}	1.1×10^{-9}
Plutonium-238 ion exchange column explosion at INL	4.9×10^{-4}	3.0×10^{-7}	7.4×10^{-2}	4.5×10^{-5}	6.9×10^{-3}	4.1×10^{-6}
Beyond-evaluation-basis earthquake at INL	8.4×10^{0}	5.0×10^{-3}	4.0×10^{3}	2.4×10^{0}	2.0×10^{2}	2.3×10^{-1}
Neptunium-237 target preparation ion exchange explosion at REDC	9.4×10^{-9}	5.6×10^{-12}	1.0×10^{-5}	6.2×10^{-9}	5.5×10^{-9}	3.3×10^{-12}
Plutonium-238 separation tank failure at REDC (neptunium-237 target)	2.2×10^{-7}	1.3×10^{-10}	3.6×10^{-4}	2.2×10^{-7}	1.2×10^{-9}	7.4×10^{-11}
Plutonium-238 ion exchange column explosion at REDC	8.9×10^{-4}	5.4×10^{-7}	9.8×10^{-1}	5.9×10^{-4}	5.2×10^{-4}	3.1×10^{-7}
Beyond-evaluation-basis earthquake at REDC	5.4×10^{1}	6.4×10^{-2}	2.9×10^{4}	1.7×10^{1}	1.0×10^{3}	1.2×10^{0}

INL = Idaho National Laboratory, REDC = Radiochemical Engineering Development Center.
[a] Likelihood of an LCF.
[b] Number of LCFs.

Table 4–33 Target Processing Annual Accident Risks Under the Consolidation with Bridge Alternative

Accident	Maximally Exposed Individual [a]	Population to 80 Kilometers (50 miles) [b]	Noninvolved Worker [a]
Neptunium-237 target preparation ion exchange explosion at INL	3.1×10^{-14}	4.8×10^{-12}	4.3×10^{-13}
Plutonium-238 separation tank failure at INL	7.5×10^{-13}	1.7×10^{-10}	1.1×10^{-11}
Plutonium-238 ion exchange column explosion at INL	3.0×10^{-9}	4.5×10^{-7}	4.1×10^{-8}
Beyond-evaluation-basis earthquake at INL	5.0×10^{-8}	2.4×10^{-5}	2.3×10^{-6}
Neptunium-237 target preparation ion exchange explosion at REDC	5.6×10^{-14}	6.2×10^{-11}	3.3×10^{-14}
Plutonium-238 separation tank failure at REDC (neptunium-237 target)	1.3×10^{-12}	2.2×10^{-9}	7.4×10^{-13}
Plutonium-238 ion exchange column explosion at REDC	5.4×10^{-9}	5.9×10^{-6}	3.1×10^{-9}
Beyond-evaluation-basis earthquake at REDC	6.4×10^{-7}	1.7×10^{-4}	1.2×10^{-5}

INL = Idaho National Laboratory, REDC = Radiochemical Engineering Development Center.
[a] Increased likelihood of an LCF.
[b] Increased number of LCFs.

Plutonium-238 Purification, Pelletization, and Encapsulation—The consequences and risks of plutonium-238 purification, pelletization, and encapsulation accidents are shown in **Table 4–34**. Four potential accidents were postulated:

- An unmitigated evaluation-basis fire during plutonium-238 powder-to-pellet fabrication. Unmitigated conditions assume failure of HVAC and fire suppression systems. The estimated frequency of this accident is 1×10^{-5} per year.
- An unmitigated evaluation-basis earthquake (0.3-g acceleration), causing failure of the HVAC, fire safety equipment, nonsafety-class ductwork, and internal nonsafety-grade structures, but not the structure shell itself. The estimated frequency of this accident is 5×10^{-4} per year.
- A beyond-evaluation-basis fire similar to the evaluation-basis fire, but involving two gloveboxes and the assumption that exterior doors are open for the duration of the fire, providing a direct unfiltered release to the environment. The estimated frequency of this accident is 1×10^{-6} per year.
- A beyond-evaluation-basis earthquake (0.5-g acceleration), with all the same assumed failures as the evaluation-basis earthquake but in addition, a 50-percent degradation in HEPA filter removal efficiency. The estimated frequency of this accident is 1×10^{-4} per year.

Table 4–34 Plutonium-238 Purification, Pelletization, and Encapsulation Annual Accident Consequences Under the Consolidation with Bridge Alternative

	Maximally Exposed Individual		*Population to 80 Kilometers (50 miles)*		*Noninvolved Worker*	
Accident	*Dose (rem)*	*Latent Cancer Fatality* [a]	*Dose (person-rem)*	*Latent Cancer Fatalities* [b]	*Dose (rem)*	*Latent Cancer Fatality* [a]
Unmitigated evaluation-basis fire at LANL	10.2	0.0061	1,850	1.11	15.9	0.0095
Unmitigated evaluation-basis earthquake at LANL	4.70	0.0028	834	0.50	7.6	0.0046
Beyond-evaluation-basis fire at LANL	5.37	0.0032	675	0.41	8.0	0.0048
Beyond-evaluation-basis earthquake at LANL	0.72	0.00043	165	0.10	1.2	0.0007
Unmitigated evaluation-basis fire at INL	0.70	0.00042	228	0.14	15.6	0.0094
Unmitigated evaluation-basis earthquake at INL	0.27	0.00016	169	0.10	6.38	0.0038
Beyond-evaluation-basis fire at INL	0.42	0.00025	84.2	0.051	7.87	0.0047
Beyond-evaluation-basis earthquake at INL	0.042	0.00025	20.0	0.012	0.98	0.00058

LANL = Los Alamos National Laboratory, INL = Idaho National Laboratory.
[a] Likelihood of an LCF.
[b] Number of LCFs.

The risks of the postulated accidents are shown in **Table 4–35**. The accident with the highest risk for the first 5-year period of the Consolidation with Bridge Alternative and for the next 35-year period is an unmitigated evaluation-basis earthquake. For the first 5 years, if this accident were to occur, the risk of an LCF would be 7.0×10^{-6} and 1.2×10^{-5} for the MEI and noninvolved worker, respectively, and, for the next 35 years, the risk would be 2.9×10^{-6} and 6.7×10^{-5}, respectively. For the first 5-year period, the risk for the offsite population would be 1.3×10^{-3}; for the next 35-year period, the risk for the offsite population would be 1.8×10^{-3}.

Table 4–35 Plutonium-238 Purification, Pelletization, and Encapsulation Annual Accident Risks Under the Consolidation with Bridge Alternative

Accident	*Maximally Exposed Individual* [a]	*Population to 80 Kilometers (50 miles)* [b]	*Noninvolved Worker* [a]
Unmitigated evaluation-basis fire at LANL	6.1×10^{-8}	1.1×10^{-5}	9.5×10^{-8}
Unmitigated evaluation-basis earthquake at LANL	1.4×10^{-6}	2.5×10^{-4}	2.3×10^{-6}
Beyond-evaluation-basis fire at LANL	3.2×10^{-9}	4.1×10^{-7}	4.8×10^{-9}
Beyond-evaluation-basis earthquake at LANL	4.3×10^{-8}	9.9×10^{-6}	7.0×10^{-8}
Unmitigated evaluation-basis fire at INL	4.2×10^{-9}	1.4×10^{-6}	9.4×10^{-8}
Unmitigated evaluation-basis earthquake at INL	8.2×10^{-8}	5.1×10^{-5}	1.9×10^{-6}
Beyond-evaluation-basis fire at INL	2.5×10^{-10}	5.1×10^{-8}	4.7×10^{-9}
Beyond-evaluation-basis earthquake at INL	2.5×10^{-9}	1.2×10^{-6}	5.8×10^{-8}

LANL = Los Alamos National Laboratory, INL = Idaho National Laboratory.
[a] Increased likelihood of an LCF.
[b] Increased number of LCFs.

Hazardous Chemical Impacts

Storage of neptunium-237 in FMF would not involve hazardous chemicals. Thus, no hazardous chemical accidents would be associated with storage of neptunium-237 in FMF (DOE 2000f).

Irradiation of neptunium-237 targets at ATR and HFIR would not introduce any additional operations that require the use of hazardous chemicals. Thus, no postulated hazardous chemical accidents would be attributable to irradiation of targets at ATR or HFIR (DOE 2000f).

Target processing at INL or REDC would involve a variety of chemicals that are potentially hazardous to workers and the public. Based on an anticipated annual inventory for 40 chemicals (DOE 2000f), two—nitric acid and hydrochloric acid—were selected for evaluation of potential impacts based on their large quantities, chemical properties, and health effects. **Table 4–36** shows the estimated stored quantities and levels of concern for these two chemicals.

Plutonium-238 purification, pelletization, and encapsulation would not require use of hazardous chemicals.

Table 4–36 Chemicals of Concern Used in Target Processing Under the Consolidation with Bridge Alternative

Chemical	*Inventory (kilograms)*	*ERPG-1* [a] *Concentration*	*ERPG-2* [b] *Concentration*	*ERPG-3* [c] *Concentration*
Nitric acid	984	1 ppm	6 ppm	78 ppm
Hydrochloric acid	146	3 ppm	20 ppm	150 ppm

ERPG = Emergency Response Planning Guideline, ppm = parts per million.
[a] ERPG-1 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odor (NOAA 2005).
[b] ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (NOAA 2005).
[c] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (NOAA 2005).
Note: To convert from kilograms to pounds, multiply by 2.2046.
Source: DOE 2000f.

The postulated accident is a catastrophic release of either of the chemicals as a result of a break in a storage vessel or piping. The cause of the break could be mechanical failure, corrosion, mechanical impact, or natural phenomena. The estimated frequency of the accident is in the range of 1.0×10^{-5} to 1.0×10^{-4} per year. The potential impacts of an accidental chemical release are shown in **Table 4–37**. The distances to the ERPG-2 and -3 levels of concern are 128 and 21 meters (140 and 23 yards), respectively, at INL and 204 and 39 meters (223 and 43 yards), respectively, at REDC for a nitric acid release. The distances to the ERPG-2 and -3 levels of concern are 232 and 80 meters (254 and 87 yards), respectively, at INL and 444 and 142 meters (486 and 155 yards), respectively, at REDC for a hydrochloric acid release. Table 4–37 also shows the estimated concentration of each chemical at a distance of 640 meters (700 yards) from the release point where a representative noninvolved worker is assumed to be located. The seriousness of the exposure of a noninvolved worker at this distance is determined by comparing the concentration at that distance to the ERPG-2 and -3 levels of concern. Table 4–37 also shows the estimated concentration at the nearest site boundary located at a distance of 5.2 kilometers (3.2 miles) at INL and 4.6 kilometers (2.9 miles) at REDC from the release point. The accident evaluation assumes a hypothetical member of the public is located at this site boundary. As in the case of the noninvolved worker, the seriousness of the exposure of a member of the public located at the nearest site boundary is determined by comparing the concentration at that distance to the ERPG-2 and -3 levels of concern. Neither the noninvolved worker nor the hypothetical member of the public would be exposed to chemical concentrations exceeding levels of concern. The direction traveled by the chemical plume would depend upon meteorological conditions at the time of the accident.

Table 4–37 Chemical Accident Impacts at Idaho National Laboratory and the Radiochemical Engineering Development Center Under the Consolidation with Bridge Alternative

Chemical	*Quantity Released (kilograms)*	*ERPG-2* [a]		*ERPG-3* [b]		*Concentration*	
		Limit	*Distance to Limit (meters)*	*Limit*	*Distance to Limit (meters)*	*Noninvolved Worker at 640 Meters*	*Nearest Site Boundary at 5.2 kilometers (INL) and 46 kilometers (REDC)*
Nitric acid at INL	2,170	6 ppm	128	78 ppm	21	0.33 ppm	0.013 ppm
Hydrochloric acid at INL	321	20 ppm	232	150 ppm	80	2.9 ppm	0.037 ppm
Nitric acid at REDC	2,170	6 ppm	204	78 ppm	39	0.72 ppm	0.027 ppm
Hydrochloric acid at REDC	321	20 ppm	444	150 ppm	142	10 ppm	0.13 ppm

ERPG = Emergency Response Planning Guideline, INL = Idaho National Laboratory, REDC = Radiochemical Engineering Development Center, ppm = parts per million.

[a] ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (NOAA 2005).

[b] ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects (NOAA 2005).

Note: To convert from kilograms to pounds, multiply by 2.2046; from meters to yards, by 1.0936; from kilometers to miles, by 0.62137.

Construction Accidents

New facility construction includes the risk of accidents that could impact workers. Because construction activities do not involve radioactive materials, there would be no radiological impacts. The presence of hazardous flammable, explosive, and other chemical substances could initiate accident conditions that could impact the health and safety of workers. In addition, in the course of their work, construction personnel and site personnel could receive serious or fatal injuries as a result of incidents that are in the category of industrial accidents. The occurrence of these incidents and their impacts cannot be meaningfully predicted. However, DOE and its construction contractors adhere to strict safety standards and procedures to provide a working environment that minimizes the possibility of accidents.

4.3.9.3 Transportation

Transportation impacts consist of: impacts of incident-free or routine transportation and impacts of transportation accidents. Incident-free transportation impacts include radiological impacts on the public and workers from the radiation field surrounding the transportation package. Nonradiological impacts of potential transportation accidents include traffic accident fatalities. See Section D.5.2 for a discussion of the human health risks from pollutants emitted by transport vehicles.

The impact of a specific radiological accident is expressed in terms of probabilistic risk, which is defined as the accident probability (i.e., accident frequency) multiplied by the accident consequences. The overall risk is obtained by summing the individual risks from all reasonably conceivable accidents. The analysis of accident risks takes into account a spectrum of accidents ranging from high-probability accidents (fender-bender) of low-consequence to high-consequence accidents that have a low probability of occurrence. The analysis approach and details on modeling and parameter selections are provided in Appendix D of this EIS.

Under this alternative, DOE would use neptunium-237 targets to produce 1 to 2 kilograms (2.2 to 4.4 pounds) of plutonium-238 for about 5 years, up to 2012, when the required facilities at MFC become available for plutonium production. Until 2012, DOE would transport neptunium-237 from INL to the REDC target fabrication facility at ORNL. Neptunium-237 targets would be transported from REDC to HFIR at ORNL for irradiation. Following irradiation in HFIR, the targets would be returned to REDC for processing. The separated plutonium-238 products would be shipped to the Plutonium Facility at LANL for purification of plutonium-238 and its encapsulation within strong cladding material for use in the RPSs. The encapsulated plutonium-238 would be shipped to MFC at INL for RPS assembly and testing. The plutonium materials would be transported between the sites using DOE's SSTs. Transportation impacts of activities within the ORNL site would be very small and enveloped by the operational impacts associated with the target fabrication and irradiation.

After 2012, DOE would use facilities at INL to fabricate and irradiate neptunium-237 targets for producing plutonium-238. The process and activities for plutonium production would be the same as those provided under the Consolidation Alternative.

This alternative would also involve the transportation of existing available inventory of plutonium-238 inside milliwatt generator heat sources from dismantled nuclear weapons. Twenty-eight shipments would occur from LANL or Pantex between 2009 and 2022.

Based on the above assumption, the offsite transportation impacts under this alternative would include those resulting from intersite shipments of neptunium and plutonium between LANL, ORNL, Pantex, and INL. This alternative would involve approximately 43 interstate shipments of radioactive materials. The total distance traveled on public roads would be about 77,200 kilometers (47,980 miles).

Impacts of Incident-Free Transportation

The dose to transportation workers from all transportation activities under this alternative has been estimated to be about 1.33 person-rem, and the dose to the public would be about 0.89 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0.00080 LCFs among transportation workers and 0.00053 LCFs in the total affected population over the duration of transportation activities. LCFs associated with radiological releases were estimated by multiplying the occupational (worker) and public dose by 6.0×10^{-4} LCFs per person-rem of exposure.

Impacts of Accidents during Transportation

As stated earlier, two sets of analyses were performed for the evaluation of transportation accident impacts: impacts of maximum reasonably foreseeable severe accidents and impacts of all conceivable accidents (total transportation accidents).

The maximum reasonably foreseeable offsite transportation accident under this alternative (probability of occurrence: more than 1 in 10 million per year) would not breach the transportation package. The consequences of most-severe accidents that could breach the transportation vehicle and its content and release radioactive materials were estimated to have a likelihood of less than 1 in 10 million per year.

As described in Appendix D, Section D.7 of this EIS, estimates of the total transportation accident risks under this alternative are as follows: a radiological dose to the population of 0.0004 person-rem, resulting in 2.44×10^{-7} LCFs, and traffic accidents resulting in 0 (0.00061) fatalities, based on 77,200 kilometers (47,980 miles) traveled.

4.3.9.4 Emergency Preparedness

Under the bridge period of this alternative, transportation of radioactive materials would occur between INL, ORNL, and LANL. Under the consolidation portions of the Consolidation with Bridge Alternative, radioactive materials would be transported only within the boundaries of INL. Radioactive waste shipments would occur to offsite waste management facilities under both portions of the Consolidation with Bridge Alternative. Section 4.1.9.4 describes emergency preparedness measures that apply to the shipment of radioactive materials and waste.

4.3.10 Environmental Justice

***Construction Impacts*—**There would be no disproportionately high and adverse environmental impacts on minority and low-income populations due to construction of RPS nuclear production facilities at MFC and the new road under this alternative. As stated in other subsections of Section 4.2, environmental impacts of construction would be small and are not expected to extend beyond the INL site boundary.

***Operational Impacts*—**No disproportionately high and adverse environmental impacts on minority and low-income populations would occur under this alternative. This conclusion is a result of analyses presented in this EIS that determined there would be no significant impacts on human health, or ecological, cultural, socioeconomic, or other resource areas described in other subsections of Section 4.2.

As discussed in Section 4.3.9.1, radiological and hazardous chemical risks to the public resulting from normal operations would be small. Routine normal operations at these facilities are not expected to cause fatalities or illness among the general population, including minority and low-income populations living within the potentially affected area.

Annual radiological risks to the offsite population that could result from accidents at these facilities are estimated to be less than 2.5×10^{-4} LCFs (see Section 4.3.9.2). Hence, the annual risks of an LCF in the entire offsite population resulting from an accident under the Consolidation with Bridge Alternative would be less than 1 in 4,000.

Subsistence Consumption of Fish, Wildlife, and Game

As previously discussed in Section 4.2.10, no disproportionately high and adverse human health impacts are expected in minority or low-income populations in the INL region as a result of subsistence consumption of fish, wildlife, native plants, or crops.

4.3.11 Waste Management and Pollution Prevention

4.3.11.1 Waste Management

The amount of waste material generated during the bridge period under the Consolidation with Bridge Alternative would be similar to the No Action Alternative, except that the plutonium-238 production rate would be limited to an annual maximum of 2 kilograms (4.4 pounds) of plutonium-238. The waste management impact under the Consolidation with Bridge Alternative would be lower during the bridge period because the production rate of plutonium-238 would be lower.

For target fabrication and post-irradiation processing, the incremental waste management impact is shown in **Table 4–38**. The waste generation in Table 4–38 is modified and reduced by a factor of 2/5, or 0.4 from Table 4–9 for the No Action Alternative, as the production rate of plutonium-238 during the bridge period is reduced by a factor of 2/5. As shown in Tables 4–9 and 4–38, the generation of waste material in both cases would be small, and the impact would be negligible.

Table 4–38 Incremental Waste Management Impacts of Operating the Radiochemical Engineering Development Center at Oak Ridge National Laboratory Under the Consolidation with Bridge Alternative

Waste Type	*Estimated Annual Waste Generation* [a] *(cubic meters, except as noted)*
Transuranic	4.4
Liquid low-level radioactive	10
Solid low-level radioactive	14
Solid mixed low-level radioactive	< 2
Hazardous	2,600 kilograms
Nonhazardous process waste water	9.2
Nonhazardous sanitary wastewater	1,133
Nonhazardous solid	59

[a] The above waste generation is prorated using Table 4–9 and is reduced by a factor of 0.4.
Note: To convert from cubic meters to cubic yards, multiply by 1.3079; from kilograms to pounds, by 2.2046.

For plutonium-238 purification, pelletization, and encapsulation, the incremental impact on waste management is shown in **Table 4–39**. As shown in Tables 4–10 and 4–39, waste generation in both cases would be small, and the impact on waste management would be negligible.

Table 4–39 Incremental Waste Management Impacts of Operating the Plutonium Facility at Los Alamos National Laboratory Under the Consolidation with Bridge Alternative

Waste Type	*Estimated Annual Waste Generation (cubic meters, except as noted)*
Transuranic	13
Low-level radioactive	150
Mixed low-level radioactive	0.34
Hazardous	< 1 kilogram [a]

[a] The amount of hazardous waste generated at the Plutonium Facility at TA-55 for the production of heat sources alone is very small. The hazardous waste generated from TA-55 overall operations is insignificant compared to other facilities at LANL.
Note: To convert from cubic meters to cubic yards, multiply by 1.3079.

In summary, the incremental impact on waste management during the bridge period under the Consolidation with Bridge Alternative would be small, and the impact on waste management at ORNL, LANL, and INL would be negligible. Impacts at INL for the last 35 years of the Consolidation with Bridge Alternative would be the same as those described in Section 4.2.11.1 for the Consolidation Alternative.

4.3.11.2 Waste Minimization and Pollution Prevention

The Consolidation with Bridge Alternative would result in continued waste generation. Waste generation activities would be scrutinized to identity opportunities for waste minimization. Wastes would be minimized where feasible by: (1) recycling; (2) processing waste to reduce its quantity, volume, or toxicity; (3) substituting materials or processes that generate hazardous wastes with others that result in less hazardous wastes; and (4) segregating waste materials to prevent contamination of nonradioactive and nonhazardous materials.

4.3.12 Environmental Restoration Program

The cleanup of past releases of contaminants at INL, ORNL, and LANL is occurring under applicable RCRA and CERCLA regulations and consent agreements. Because current activities at the sites would continue under the bridge period of this alternative, no impacts on the Environmental Restoration Programs are anticipated.

As described in Section 4.2.12, the consolidation of nuclear operations in the support of RPS production at INL under the Consolidation with Bridge Alternative is not expected to impact the Environmental Restoration Program at INL. Cessation of RPS production activities at ORNL and LANL after the consolidation of RPS nuclear production operations at INL would not impact the Environmental Restoration Programs at these sites. REDC at ORNL and the Plutonium Facility at LANL would continue to operate and would not be decommissioned.

4.4 Cumulative Impacts

The Council on Environmental Quality (CEQ) regulations (40 CFR 1500-1508) define cumulative effects as impacts on the environment that result from the Proposed Action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions (40 CFR 1508.7). Thus, the cumulative impacts of an action can be viewed as the total effects on a resource, ecosystem, or human community of that action and all other activities affecting that resource, no matter what entity (Federal, non-Federal, or private) is taking the action (EPA 1999).

Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time. Cumulative effects can also result from spatial (geographic) and/or temporal (time) crowding of environmental perturbations. Said another way, the effects of human activities will accumulate when a second perturbation occurs at a site before the system can fully rebound from the effect of the first perturbation.

The cumulative impacts for INL, ORNL, and LANL are presented in this section. Since new facilities and operations would be added to INL under the Consolidation and Consolidation with Bridge Alternatives, the cumulative impact of these new facilities and operations is presented in the following sections. Since no new facilities would be constructed at ORNL and LANL and since REDC and HFIR at ORNL and the Plutonium Facility at LANL are currently operating facilities, the projected incremental contributory effects of RPS nuclear production operations at these facilities on site operations would result in essentially no change in overall site impacts. In addition, most of the ongoing and reasonably foreseeable future actions planned for ORNL and LANL have already been addressed in the No Action Alternative presented in Section 4.1. Cumulative impacts were evaluated only for those ”resources” that could be affected by RPS nuclear production operations at ORNL and LANL. These include site infrastructure requirements, air quality, human health, and waste management.

Cumulative Impacts at Oak Ridge National Laboratory and Oak Ridge Reservation

Site Infrastructure Requirement Impacts—Infrastructure requirements at ORNL would remain well within ORR's site capacities. If the No Action and Consolidation with Bridge Alternatives were implemented, the REDC and HFIR would require essentially no change in the site's use of electricity or water.

Air Quality Impacts—ORNL and ORR are currently in compliance with all Federal and State ambient air quality standards, and would continue to be in compliance even if the cumulative effects of all activities are included. The contributions from RPS nuclear production operations to overall site concentrations would be very small.

Public and Occupational Health and Safety – Normal Operations Impacts—There would be no increase expected in the number of latent cancer fatalities in the population from operations at ORNL and ORR if RPS nuclear production operations were to occur at HFIR and REDC. The dose limits for individual members of the public are given in DOE Order 5400.5. As discussed in that order, the dose limit from airborne emissions is 10 millirem per year, as required by the Clean Air Act; the dose limit from drinking water is 4 millirem per year, as required by the Safe Drinking Water Act; and the dose limit from all pathways combined is 100 millirem per year. The dose to the MEI would be expected to remain well within the regulatory limits. Onsite workers would be expected to see an increase of approximately 0.0036 latent cancer fatalities due to radiation from RPS nuclear production operations over the 35-year operational period.

Waste Management Impacts—It is unlikely that there would be major impacts on waste management at ORNL and ORR because sufficient capacity would exist to manage the site wastes. Neither the No Action nor Consolidation with Bridge Alternatives would generate more than a small amount of additional waste at ORNL.

Cumulative Impacts at Los Alamos National Laboratory

Site Infrastructure Requirement Impacts—Infrastructure requirements at LANL would remain within site capacities. No infrastructure capacity constraints are anticipated, as LANL operational demands to date on key infrastructure resources, including electricity and water, have been well below projected levels and well within site capacities. The ongoing use of LANL's Plutonium Facility at TA-55 would require essentially no change in the site's use of electricity or water.

Air Quality Impacts—LANL is currently in compliance with all Federal and State ambient air quality standards, and would continue to be in compliance even if the cumulative effects of all activities are included. The contributions from RPS nuclear production operations to overall site concentrations would be very small.

Public and Occupational Health and Safety – Normal Operations Impacts—There would be no increase expected in the number of latent cancer fatalities in the population from the Plutonium Facility at LANL from RPS nuclear production operations. The dose limits for individual members of the public are given in DOE Order 5400.5. As discussed in that order, the dose limit from airborne emissions is 10 millirem per year, as required by the Clean Air Act; the dose limit from drinking water is 4 millirem per year, as required by the Safe Drinking Water Act; and the dose limit from all pathways combined is 100 millirem per year. The dose to the MEI would be expected to remain well within the regulatory limits. Onsite workers would be expected to see an increase of approximately 0.005 latent cancer fatalities due to radiation from RPS nuclear production operations over the 35-year operational period. Approach to Cumulative Impacts at Idaho National Laboratory

This *Consolidation EIS* adopts, and updates where needed, the cumulative impacts analyses presented in the *Idaho HLW and Facilities Disposition EIS* (DOE 2002e), and the *Final Environmental Impact Statement for the Proposed Relocation of Technical Area 18 Capabilities and Materials at the Los Alamos National Laboratory* (*TA-18 Relocation EIS*) (DOE 2002d). In general, the following approach was used:

- The ROIs for impacts associated with projects analyzed in this EIS were defined.
- The affected environment and baseline conditions were identified.
- Past, present, and reasonably foreseeable actions and the effects of those actions were identified.
- Aggregate (additive) effects of past, present, and reasonably foreseeable actions were assessed.

As described above, cumulative impacts were assessed by combining the smallest and largest potential effects of *Consolidation EIS* alternative activities with the effects of other past, present, and reasonably foreseeable actions in the ROI. Many of these actions occur at different times and locations, and may not be truly additive. For example, the set of actions that impact air quality occurs at different times and locations across the ROI, and, therefore, it is unlikely that the impacts are completely additive. The effects were combined irrespective of the time and location of the impact, even though they do not necessarily occur in the same timeframe, to envelop any uncertainties in the projected activities and their effects. This approach produces a maximum estimation of cumulative impacts for the activities considered. The detailed description of the cumulative impacts methodology is presented in Section B.13.

4.4.1 Past and Present Actions at Idaho National Laboratory

To determine the baseline impacts on a resource, the impacts of past and present actions need to be identified. For most resource areas, baseline impacts can be culled from information on the affected environment provided in Chapter 3 of this EIS. For example, the current air quality in the region as described in Chapter 3 reflects both past and present activities occurring in the region. In contrast, current resource use alone may not adequately account for past resource loss and, therefore, would not be a good indicator of baseline impacts.

Past and present actions that may contribute to cumulative impacts include those conducted by government agencies, businesses, or individuals that are within the ROIs considered. Examples of past INL activities include operation of fuel fabrication plants, research and test reactors, and fuel processing and research facilities; spent fuel treatment and storage; and treatment and disposal of waste. Current INL activities include operation of research and test reactors; spent fuel treatment and storage; waste treatment and disposal; site cleanup; and research and development. **Table 4–40** lists activities included in the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (Spent Nuclear Fuel EIS)*. As noted in this table, some of these actions were later cancelled. Therefore, it is likely that the cumulative impact analyses presented in the *Spent Nuclear Fuel EIS* are conservative.

Examples of offsite activities that may contribute to cumulative impacts include clearing land for agriculture and urban development, grazing, water diversion and irrigation projects, power generation projects, waste management activities, industrial emissions, and development of transportation and utility networks.

4.4.2 Reasonably Foreseeable Actions at Idaho National Laboratory

As stated in principle of cumulative effects analysis (CEQ 1997) No. 1, *"Cumulative effects are caused by the aggregate of past, present, and reasonably foreseeable future actions."* Principle No. 2 further states, *"Cumulative effects are the total effect….of all actions taken, no matter who (Federal, non-Federal, or private) has taken the actions."* Therefore, it is important to identify future actions that may appreciably degrade the resources or can add to the impacts of other actions, regardless of the agency or individual undertaking the action. Past, present, and reasonably foreseeable onsite actions included in the cumulative impacts analysis are presented in **Table 4–41**. Future actions that are speculative or not well defined were not analyzed.

Table 4–40 Activities Included in the *Spent Nuclear Fuel EIS* Assessment of Cumulative Impacts

Activity	*Activity*
Borrow Source Silt Clay	Partnership Natural Disaster Reduction Test Station
Calcine Transfer Project	Nonincinerable Mixed Waste Treatment
Central Liquid Waste Processing Facility D&D	Pit 9 Retrieval
Dry Fuels Storage Facility	Private Sector Alpha-Mixed Low-Level Waste Treatment
Environmental Assessment Determination for CPP-627	Radioactive Scrap/Waste Facility
EBR-II Blanket Treatment	Remediation of Groundwater Facilities
EBR-II Plant Closure	Remote Mixed Waste Treatment Facility
Expended Core Facility Dry Cell Project	Radiological and Environmental sciences Laboratory Replacement
Engineering Test Reactor D&D	RWMC Modification for Private Sector Treatment of Alpha-Mixed Low-Level Waste [a]
Fuel Processing Complex (CPP-601) D&D	Sodium Processing Plant
Fuel Receiving, Canning, Characterization, and Shipping	Test Area North Pool Fuel Transfer
Gravel Pit Expansions (New Borrow Source)	Tank Farm Heel Removal Project
Greater than Class C Dedicated Storage	Treatment of Alpha-Mixed Low-Level Waste
Headend Processing Plant (CPP-640) D&D	Transuranic Storage Area Enclosure and Storage Project
Health Physics Instrument Lab	Vadose Zone Remediation
High-Level Waste Tank Farm Replacement (upgrade phase) [a]	Waste Calcine Facility (CPP-633) D&D
Increased Rack Capacity for CPP-666 [a]	Waste Characterization Facility
Industrial Landfill Expansion	Waste Handling Facility [a]
Material Test Reactor D&D	Waste Immobilization Facility
Mixed Low-Level Waste Disposal Facility [a]	Waste Experimental Reduction Facility Incineration

D&D = decontamination and decommissioning, CPP = Chemical Processing Plant (now known as the Idaho Nuclear Technology and Engineering Center), EBR = Experimental Breeder Reactor, RWMC = Radioactive Waste Management Complex.

[a] These activities were later cancelled (DOE 2002f).

Source: DOE 2002e.

An understanding of expected future land use sets the stage for reasonably foreseeable actions that may occur at INL in the future. The *Environmental Management Performance Management Plan for Accelerating Cleanup of the Idaho National Engineering and Environmental Laboratory* (DOE 2002b), describes DOE's plan to accelerate the reduction of environmental risk at INL by completing its cleanup responsibility faster and more efficiently. The plan describes how DOE will address risk reduction and elimination by stabilizing and dispositioning materials such as sodium-bearing liquid wastes, spent nuclear fuel, and special nuclear materials many years earlier than currently planned. The plan describes nine strategic initiatives DOE proposes to eliminate or reduce environmental risks at INL (DOE 2002b). The strategic initiatives are:

- Accelerate tank farm closure.
- Accelerate high-level radioactive waste calcine removal from Idaho.
- Accelerate consolidation of spent nuclear fuel to the Idaho Nuclear Technology and Engineering Center (INTEC).

Table 4–41 Additional Onsite Actions Included in the *Idaho High-Level Waste and Facilities Disposition Final EIS* Assessment of Cumulative Impacts

Project	*Description*
Spent nuclear fuel management and environmental restoration	Spent nuclear fuel management and environmental restoration activities as described in the *Spent Nuclear Fuel EIS*. Activities included in this EIS are listed in Table 4–40.
Advanced Mixed Waste Treatment Project	Retrieve, sort, characterize, and treat mixed low-level radioactive waste and approximately 65,000 cubic meters of alpha-contaminated mixed low-level radioactive waste and transuranic waste currently stored at the INL Radioactive Waste Management Complex. Package the treated waste for shipment offsite for disposal.
Waste area group 3 remediation	Ongoing activities addressing remediation of past releases of contaminants at INTEC
New silt/clay source development	INL activities require silt/clay for construction of soil caps over contaminated sites, research sites, and landfills; replacement of radioactively contaminated soil with topsoil for revegetation and backfill; sealing of sewage lagoons; and other uses. Silt/clay will be mined from three onsite sources (ryegrass flats, spreading areas A, and Water Reactor Research Test Facility).
Closure of various INTEC facilities unrelated to *Idaho HLW and Facilities Disposition EIS* Alternatives	Reduce the risk of radioactive exposure and release of hazardous constituents and eliminate the need for extensive long-term surveillance and maintenance for obsolete facilities at INTEC.
Percolation pond replacement	DOE intends to replace the existing percolation ponds at INTEC with replacement ponds located approximately 10,200 feet southwest of the existing ponds.
Treatment and management of sodium-bonded spent nuclear fuel	Treatment of sodium-bonded spent nuclear fuel at MFC using the electrometallurgical process.

INL = Idaho National Laboratory, INTEC = Idaho Nuclear Technology and Engineering Center, MFC = Materials and Fuels Complex.
Note: To convert from cubic meters to cubic yards, multiply by 1.3079; from meters to yards, by 1.0936.
Source: DOE 2002e.

- Accelerate offsite shipments of transuranic waste stored at the Transuranic Storage Area.
- Accelerate remediation of miscellaneous contaminated areas.
- Eliminate onsite treatment and disposal of low-level radioactive waste and mixed low-level radioactive waste.
- Transfer all Environmental Management-managed special nuclear material offsite.
- Remediate buried waste at the Radioactive Waste Management Complex.
- Accelerate consolidation of INL facilities and reduce the footprint.

At the 2020 end state in the plan, some activities would continue: shipment of spent nuclear fuel to a repository; retrieval, treatment, packaging, and shipment of calcine high-level radioactive waste to a repository; and final dismantlement of remaining Environmental Management buildings. Additionally, the site will continue with ongoing activities such as groundwater monitoring well beyond the 2020 end state identified in this plan. These activities will be complete by 2035, with the exception of some minor activities leading to long-term stewardship (DOE 2002b).

An environmental assessment (EA) is currently being prepared for the Remote Treatment Facility, which would be located in MFC and would treat large pieces of equipment that require remote handling.

A potential future project identified but not considered in the cumulative impacts analysis because of its speculative nature involves the INTEC coal-fired steam heating plant. The plant could be converted to a small commercial power generating facility. The potential for such a conversion is being considered by the Eastern Idaho Community Reuse Organization (DOE 2002e, INL 2005c).

It is also necessary to consider activities implemented by other Federal, state, and local agencies and individuals outside INL, but within the ROI. This may include state or local development initiatives; new industrial or commercial ventures; new utility or infrastructure construction and operation; new waste treatment and disposal; and new residential development. The city of Idaho Falls, Butte, Bingham, Bonneville, Clark, and Jefferson Counties; the Idaho Department of Transportation; and the U.S. Forest Service were contacted for information regarding anticipated future activities that could contribute to cumulative impacts. Bingham and Bonneville Counties did not identify any major future actions (INL 2005c, INL 2005c). Activities in the region surrounding INL that were identified include:

- City of Idaho Falls – identified continued development similar to what has occurred in 2004 (295 homes and 55,742 square meters [600,000 square feet] of retail space built) (INL 2005c); and

- Jefferson County – studying possible regionalized wastewater treatment (INL 2005c).

Information on transportation projects was collected to determine if major projects could impact the region around INL (BMPO 2004, ITD 2005a, ITD 2005b, WFLHD 2005). Some of the more substantial transportation projects in the region include:

- New Interstate-15 interchange and bridge over the Snake River at milepost 116 (2004 to 2006) (ITD 2005b),

- Major widening of U.S. Route 20 near Idaho Falls (2005) (ITD 2005a),

- Major widening of State Road 7446 in Idaho Falls (2005) (ITD 2005a),

- Major widening of Interstate-86B near junction with State Highway 39 (2006) (ITD 2005a),

- Add lanes to U.S. Route 26 near Idaho Falls (2007) (BMPO 2004, ITD 2005a),

- Major widening of Interstate-86 near junction with U.S. Route 91 (2007) (ITD 2005a),

- Major widening of U.S. Route 91 near Blackfoot (2007) (ITD 2005a), and

- Major widening of State Road 7401 near Interestate-86 (2008) (ITD 2005a).

Although the transportation infrastructure in the region would continued to be maintained, and some upgrade, expansion, and widening projects are schedule over the next 5 years or so, no new major roadways that could contribute substantially to cumulative impacts are scheduled.

Because of the distance from the MFC and ATR sites at INL; the routine nature and relatively small size of the other actions considered; and the zoning, permitting, environmental review, and construction requirements that these actions must meet, they are not expected to substantially contribute to cumulative impacts.

4.4.3 Cumulative Impacts at Idaho National Laboratory

The following resource areas have the potential for cumulative impacts: land resources, site infrastructure (i.e., socioeconomics; electricity, and water use), geology and soils, air quality, ecological resources, cultural resources, public health and safety, occupational health and safety, transportation, and waste management. Cumulative impacts for these resource areas are presented below.

4.4.3.1 Land Resources

Cumulative impacts on land use at INL are presented in **Table 4–42**. Cumulative actions are expected to disturb 5,258 to 5,333 hectares (12,993 to 13,178 acres), or 2 percent of the 230,700 hectares (570,000 acres) of land on INL. The alternatives for RPS production would disturb a maximum of 75 hectares (185 acres) of land. This value includes the areas disturbed for construction of the new facilities and road and to obtain sand and gravel. The maximum impact *Consolidation EIS* alternative would occupy less than 0.1 percent of the INL land area. Some of this land could be returned to productive uses after facility decommissioning. Use of land within the RTC and MFC would be consistent with current industrial land uses.

Table 4–42 Cumulative Land Use Impacts at Idaho National Laboratory

Activity		***Land Use Commitment (hectares)***
Past, Present, and Reasonably Foreseeable Future Actions		
Existing site activities [a]		4,600
Spent nuclear fuel management and INL environmental restoration and waste management (DOE 2002e)		545
High-level radioactive waste and facilities disposition (DOE 2002e)		9
New silt/clay source development (DOE 1997a)		97
Percolation pond replacement (DOE 2002e)		7
Subtotal Baseline Plus Other Actions		5,258
Consolidation EIS Alternatives [b]	No Action	0
	Consolidation	75
	Consolidation with Bridge	75
Total [c]		5,258 to 5,333
Total Site Capacity [d]		230,700

INL = Idaho National Laboratory.
[a] From Chapter 3 of this EIS.
[b] Impact indicator values from this Chapter 4. Includes borrow area disturbed to supply sand and gravel.
[c] Total is a range that includes the minimum and maximum values from the *Consolidation EIS* alternatives. Total may not equal the sum of the contributions due to rounding.
[d] Total of INL land areas from Chapter 3 of this EIS.
Note: To convert from hectares to acres, multiply by 2.471.

4.4.3.2 Site Infrastructure

Cumulative impacts on site infrastructure at INL are presented in **Table 4–43**. *Consolidation EIS* alternatives would use from approximately 2,039 to 10,639 megawatt-hours per year of electricity and 28 to 75 million liters (7.4 to 20 million gallons) of water per year. Table 4–43 indicates that INL would remain within its capacity to deliver electricity and water. Cumulatively, up to 52 percent of the electrical energy capacity and 11 percent of the water supply capacity could be used.

4.4.3.3 Geology and Soils

Construction of the new facilities and new road would require use of borrow materials such as gravel, silt and clay. Sources of sand, gravel, and aggregate in support of remedial activities and INL operations were evaluated in the *Spent Nuclear Fuel EIS*. The need for sand and gravel is estimated to be 1,354,740 cubic meters (1,772,000 cubic yards) (DOE 1995).

Table 4–43 Cumulative Site Infrastructure Impacts at Idaho National Laboratory

Activity		*Peak Site Employment (persons)*	*Electricity Consumption (megawatt-hours per year)*	*Water Usage (million liters per year)*
Past, Present, and Reasonably Foreseeable Future Actions				
Existing site activities [a]		8,100	156,639	4,200
Spent nuclear fuel management and INL environmental restoration and waste management (DOE 2002d)		(b)	2,200	2
Foreign research reactor spent nuclear fuel management (DOE 2002d)		(b)	1,000	2
Waste management (DOE 2002d)		(b)	13,980	194
High-level radioactive waste and facilities disposition (DOE 2002d and 2002e)		870	33,000	394
Advanced Mixed Waste Treatment Project (DOE 2002d)		(b)	33,000	16
Subtotal Baseline Plus Other Actions		8,970	239,819	4,808
Consolidation EIS Alternatives [c]	No Action	0	2,039	28
	Consolidation	245/75	10,639	75
	Consolidation with Bridge	245/75	10,639	75
Total [d]		8,970 to 9,215	241,858 to 250,458	4,836 to 4,883
Total Site Capacity [a]		Not applicable	481,800	43,000

INL = Idaho National Laboratory.
[a] From Chapter 3 of this EIS.
[b] Employment for this activity is included in the 8,100 existing employees.
[c] Impact indicator values from this chapter. Peak site employment includes 245 short-term construction workers. Seventy-five workers are associated with long-term operation of the new facilities.
[d] Total is a range that includes the minimum and maximum values from the *Consolidation EIS* alternatives. Total may not equal the sum of the contributions due to rounding.
Note: To convert from liters to gallons, multiply by 0.26418.

Anticipated requirements for geologic materials were identified in an EA addressing impacts of developing new sources of silt and clay to support INL actions (DOE 1997a). The EA identified a need for 3,516,820 cubic meters (4,600,000 cubic yards) of silt/clay material over a period of 10 years. Most of these resources would be obtained from the areas of INL set aside for removal of borrow material (i.e., ryegrass flats, spreading areas A, and the Water Reactor Research Test Facility). Silt and clay required for construction activities associated with waste processing and facilities disposition, as well as material for all other INL activities, including ongoing operations and remediation of contaminated sites, would be obtained from sources analyzed in the EA. The development or expansion of borrow material sources would be within the boundaries of INL; the acreage used would be small and subject to standard cultural resource protection measures and site restoration, including revegetation with native plant species.

As shown in **Table 4–44**, some 4,871,560 to 5,126,560 million cubic meters (6,372,000 to 6,705,540 million cubic yards) of geologic resources could be extracted from the areas set aside for this purpose. As described in this chapter, *Consolidation EIS* alternatives would use up to 255,000 cubic meters (333,540 cubic yards) of geologic materials. It is expected that the geologic resources available in the areas set aside for this purpose could satisfy these demands. Therefore, cumulative impacts on site geology and soils are anticipated to be minor.

Table 4–44 Cumulative Geologic Material Requirements at Idaho National Laboratory

Activity		*Geologic Materials Needed (cubic meters)*
Past, Present, and Reasonably Foreseeable Future Actions		
Spent nuclear fuel management and Idaho National Laboratory environmental restoration and waste management (DOE 2002e)		1,354,740
New silt/clay source development (DOE 2002e)		3,516,820
Subtotal Other Actions		4,871,560
Consolidation EIS Alternatives [a]	No Action	0
	Consolidation	255,000
	Consolidation with Bridge	255,000
Total [b]		4,871,560 to 5,126,560

[a] Impact indicators from this Chapter 4.
[b] Total is a range that includes the minimum and maximum values from the *Consolidation EIS* alternatives. Total may not equal the sum of the contributions due to rounding.
Note: To convert from cubic meters to cubic yards, multiply by 1.3079.

4.4.3.4 Air Quality

Cumulative impacts of criteria pollutants are shown in **Table 4–45**. Cumulative impacts of radiological air pollutants are discussed in Section 4.4.4.8 on Public Health and Safety. Table 4–45 indicates that air quality standards for carbon monoxide, nitrogen oxides, PM, and sulfur oxides would not be exceeded at the INL boundary or along public roadways.

The cumulative impacts analysis is very conservative because many of the air pollutant releases would occur at different times and locations and may not be additive. Activities that would cause air quality standards to be exceeded would not be allowed.

4.4.3.5 Ecological Resources

Cumulative impacts on INL ecology of habitat loss as a result of any alternative analyzed in this EIS would be small. Measurable impacts on populations on or off INL have not occurred and are not expected as a result of the incremental increase in exposure to radionuclides or chemicals that could result under alternatives analyzed in this EIS. Additional deposition resulting from any of the alternatives analyzed in this EIS is not expected to lead to levels of contaminants that would exceed the historically reported range of concentrations. Therefore, DOE anticipates minimal cumulative impacts on the INL ecology and/or plant and animal populations as a result of any alternative analyzed in this EIS.

4.4.3.6 Cultural Resources

As stated above, the majority of reasonably foreseeable INL actions would occur within previously disturbed areas contained within or adjacent to developed areas. The likelihood that these areas contain cultural materials intact or in their original context is small. Nevertheless, there is the potential to unearth or expose cultural materials during excavation. Standard measures to avoid or minimize the impacts on cultural materials discovered during site development are in place. Cultural resource surveys would be conducted prior to construction or surface disturbance outside the MFC fence, and along the proposed new road, and appropriate standard measures, such as avoidance or scientific documentation and tribal consultation, would be implemented prior to development. No decision would be made relative to construction of any proposed facilities or the new road prior to completion of the consultation process. Implementation of these measures would minimize the potential for impacts, including cumulative impacts, on cultural resources. The contribution of activities evaluated in this EIS to cumulative impacts on cultural and historic resources on INL or in southeastern Idaho is expected to be minimal.

Table 4–45 Cumulative Air Quality Impacts of Criteria Pollutants at Idaho National Laboratory

Activity		*Maximum Average Concentration (micrograms per cubic meter)* *Carbon Monoxide*	*Nitrogen Oxides*	*Particulate Matter (PM_{10})*	*Sulfur Oxides*
Past, Present, and Reasonably Foreseeable Future Actions					
INL site baseline [a]		71	2.3	20	140
Treatment and management of sodium-bonded spent nuclear fuel (DOE 2002d)		0	0	0	0
High-level radioactive waste and facilities disposition (DOE 2002d) [b]		4.0	0.10	0	10
New silt/clay source development (DOE 1997a)		No data	No data	18	No data
Subtotal Baseline Plus Other Actions		75	2.4	38	150
Consolidation EIS Alternatives [c]	No Action	Negligible	Negligible	Negligible	Negligible
	Consolidation	0.076	0.025	0.016	0.74
	Consolidation with Bridge	0.076	0.025	0.016	0.74
Total [d]		75	2.4	35	151
Most Stringent Standard or Guideline		10,000 (8 hours)	100 (annual)	150 (24 hours)	1,300 (3 hours)

PM_{10} = particulate matter less than or equal to 10 micrometers in aerodynamic diameter, INL = Idaho National Laboratory.

[a] From Chapter 3, including reasonably foreseeable sources, Advanced Mixed Waste Treatment Project (DOE 1999b), and the *Idaho HLW and Facilities Disposition EIS* Continued Operations Alternative (DOE 2002e) (to account for steam boilers).

[b] Difference between Planning Basis Alternative and Continued Operations Alternative.

[c] Impact indicator values from this Chapter 4.

[d] Total is a range that includes the minimum and maximum values from the *Consolidation EIS* alternatives. Total may not equal the sum of the contributions due to rounding.

4.4.3.7 Socioeconomics

As shown in Table 4–43, cumulative employment at INL could reach 9,215 persons. This value is a conservative estimate of future employment at INL. Some of the employment would occur at different times and may not be additive. It is likely that some employees are being counted twice; once as part of the baseline, and again as part of new projects. In addition, this estimate assumes that baseline employment would continue at current levels; this is highly unlikely. The projected baseline for INL shows declining employment. Overall, INL employment may decline at an even faster rate than presently forecast, depending on the success of accelerated site cleanup (DOE 2002b). Future employment for RPS fabrication may act to reduce the adverse effects of a reduction in baseline employment. Considering that direct employment at INL was approximately 11,000 workers in 1990 (DOE 1995) and approximately 8,100 workers in 2001 (see Section 3.2.8), future changes in employment as a result of activities described in this EIS would be within normal workforce fluctuations.

A maximum of 245 new employees could move into the area to support construction activities. As described earlier in this chapter, these new arrivals would not strain the capacities of housing or community services or the transportation network. Only 75 employees would be required for operation of the new facilities.

4.4.3.8 Public Health and Safety

A summary of cumulative radiological impacts on public health due to radiological air emissions from past, present, and reasonably foreseeable future activities at INL is provided in **Table 4–46**. The cumulative population dose from INL operations is estimated to be 0.35 person-rem per year. The number of LCFs from this population dose would be much less than 1.

Table 4–46 Cumulative Population Health Effects of Exposure to Contaminants in Air at Idaho National Laboratory

Activity		*General Population* [a]		*Maximally Exposed Individual*	
		Dose (person-rem per year)	*Latent Cancer Fatalities* [b]	*Dose (millirem per year)*	*Latent Cancer Fatalities* [b]
Past, Present, and Reasonably Foreseeable Future Actions					
Existing site activities [c]		0.022	1.3×10^{-5}	0.035	2.1×10^{-8}
Spent nuclear fuel management and INL environmental restoration and waste management (DOE 2002d)		0.19	1.1×10^{-4}	0.008	4.8×10^{-9}
Foreign research reactor spent nuclear fuel management (DOE 2002d)		0.0045	2.7×10^{-6}	5.6×10^{-4}	3.4×10^{-10}
Treatment and management of sodium-bonded spent nuclear fuel (DOE 2002d)		0.012	7.2×10^{-6}	0.002	1.2×10^{-9}
Storage and disposition of weapons-usable fissile materials (DOE 2002d)		1.8×10^{-5}	1.1×10^{-8}	1.6×10^{-6}	9.6×10^{-13}
High-level radioactive waste and facilities disposition (DOE 2002e)		0.11	6.6×10^{-5}	0.0018	1.1×10^{-9}
Advanced Mixed Waste Treatment Project (DOE 2002d)		0.009	5.4×10^{-6}	0.022	1.3×10^{-8}
Subtotal Baseline Plus Other Actions		0.35	2.1×10^{-4}	0.069	4.1×10^{-8}
Consolidation EIS Alternatives [d]	No Action	6.0×10^{-5}	3.6×10^{-8}	1.4×10^{-7}	2.9×10^{-12}
	Consolidation	6.7×10^{-4}	4.1×10^{-7}	1.6×10^{-6}	3.4×10^{-11}
	Consolidation with Bridge	7.1×10^{-4}	4.2×10^{-7}	1.6×10^{-6}	3.4×10^{-11}
Total [e]		0.35	2.1×10^{-4}	0.069 [f]	4.1×10^{-8} [f]

INL = Idaho National Laboratory.
[a] The exposed population used to estimate population dose varies over time. As described in Section 3.2.9.1, the population living within 80 kilometers (50 miles) of any INL facility is estimated to be 276,979 in 2003.
[b] LCFs calculated using a conversion of 0.0006 LCFs per person-rem.
[c] From Chapter 3 of this EIS.
[d] Impact indicators from this Chapter 4.
[e] Total is a range that includes the minimum and maximum values from the *Consolidation EIS* alternatives. Total may not equal the sum of the contributions due to rounding.
[f] The same individual is not expected to be the MEI for all activities at INL. The location of the MEI depends upon where on the site an activity is performed. However, to provide an upper bound of the cumulative impacts on the MEI, the impacts of each activity have been summed.

As described in this chapter, *Consolidation EIS* alternatives would range from 6.0×10^{-5} to 7.1×10^{-4} person-rem and 3.6×10^{-8} to 4.2×10^{-7} LCFs. For perspective, the doses to the local population (276,979 persons in 2003) from naturally occurring radioactive sources (359 millirem-per-person-per-year) would result in about 99,000 person-rem per year, from which about 60 LCFs would be inferred.

Table 4–46 indicates that the cumulative dose to the MEI is estimated to be 0.069 millirem per year. This is a very conservative estimate of potential dose to an MEI because the activities contributing to the dose are not likely to occur at the same time and location. These estimates of cumulative dose to the MEI are well below the 10-millirem-per-year EPA limit.

Other regional sources of atmospheric radioactivity have the potential to contribute to the dose received by the public near INL. The primary non-INL source of airborne radioactivity is emissions from phosphate processing operations in Pocatello, Idaho. The number of fatal cancers in the population within 80 kilometers (50 miles) of the Pocatello phosphate processing operations is estimated to be about 1 over a 10-year period. INL and the Pocatello phosphate plants are separated by enough distance that the population evaluated does not completely overlap the population evaluated in this EIS. The population exposed to the cumulative impact of both facilities would be minimal (DOE 2002e).

In addition to radiation dose from atmospheric emissions, there is a potential for impacts on the public of exposure to carcinogenic chemicals released to the air. INL operations are not anticipated to exceed applicable standards when emissions under the alternatives analyzed in this EIS are considered in conjunction with existing and anticipated emissions. The highest risks calculated indicate less than one fatal cancer in the exposed population. Therefore, minimal health effects of chemical carcinogen releases are anticipated. No basis for use in evaluating risks from chemical exposure due to other regional commercial, industrial, and agricultural sources, such as combustion of diesel or gasoline fuels and agricultural use of pesticides, herbicides, and fertilizers, is available. Therefore, the cumulative health effects in the general population of INL activities combined with other sources of chemical exposure cannot be estimated (DOE 2002e).

4.4.3.9 Occupational Health and Safety

As shown in **Table 4–47**, the maximum cumulative annual INL worker dose, could total 390 to 422 person-rem, which would result in less than one (0.23 to 0.25) LCF. As described in this chapter, *Consolidation EIS* alternatives could produce annual worker doses of 1.2 to 33 person-rem, resulting in 0.00072 to 0.020 LCFs. Note that DOE regulations limit routine worker exposure to 5 rem per year (10 CFR 835) and recommend a lower Administrative Control Level of 0.5 rem per year.

Table 4–47 Cumulative Health Effects on the Idaho National Laboratory Worker

Activity		*Dose (person-rem per year)*	*Latent Cancer Fatalities* [b]
Past, Present, and Reasonably Foreseeable Future Actions			
Existing site activities [a]		240	0.14
Spent nuclear fuel management and INL environmental restoration and waste management (DOE 2002d)		5.4	0.0032
Foreign research reactor spent nuclear fuel (DOE 2002d)		33	0.020
Treatment and management of sodium-bonded spent nuclear fuel (DOE 2002d)		22	0.013
Storage and disposition of weapons-usable fissile materials (DOE 2002d)		25	0.015
High-level radioactive waste and facilities disposition (DOE 2002d)		59	0.035
Advanced Mixed Waste Treatment Project (DOE 2002d)		4.1	0.0025
Subtotal Baseline Plus Other Actions		389	0.23
Consolidation EIS Alternatives [c]	No Action	1.2	0.00072
	Consolidation	32	0.019
	Consolidation with Bridge	33	0.020
Total [d]		390 to 422	0.23 to 0.25

INL = Idaho National Laboratory.
[a] From Chapter 3 of this EIS.
[b] LCFs calculated using a conversion of 0.0006 LCFs per person-rem.
[c] Impact indicators from this Chapter 4.
[d] Total is a range that includes the minimum and maximum values from the *Consolidation EIS* alternatives. Total may not equal the sum of the contributions due to rounding.

4.4.3.10 Transportation

The cumulative health effects to the transportation workers (truck or rail crew) and population over approximately 100 years of radioactive material and waste transport are shown in **Table 4–48**. One hundred years is approximately the period of time from the start of operations at INL in the 1940s to the end of the period of analysis for this EIS in the 2040s. Cumulative transportation impacts are predicted to result in approximately 180 worker (truck crew) LCFs, 183 LCFs in the general population, and 74 traffic fatalities. Most of the estimated health effects are associated with general radioactive waste and materials transport related to non-DOE activities such as medical isotope transport, and commercial low-level radioactive waste transport. *Consolidation EIS* alternatives are expected to result in a very small number (less than one) of worker and public LCFs and a very small number (less than one) of traffic fatalities and therefore would not contribute substantially to cumulative impacts.

Table 4–48 Cumulative Truck Transportation Impacts

Activity		*Worker*		*General Population*		*Traffic Fatalities* [a]
		Dose (person-rem)	*Latent Cancer Fatalities*	*Dose (person-rem)*	*Latent Cancer Fatalities*	
Past, Present, and Reasonably Foreseeable Future Actions						
Historical transportation of waste and spent nuclear fuel (DOE 2002e)		109	0.065	60	0.036	No data
Spent nuclear fuel (DOE 1995, 2002e)		1,200	0.72	1,300	0.78	0.77
Treatment and management of sodium-bonded spent nuclear fuel (DOE 2004a)		1.7	0.001	1.7	0.001	0.001
Surplus plutonium disposition (DOE 2004a)		60	0.036	67	0.040	0.053
DOE-wide waste management (DOE 2004a)		16,667	10	20,000	12	36
High-level radioactive waste and facilities disposition (DOE 2002e)		520	0.31	2,900	1.7	0.98
Reasonably foreseeable actions, including transport to WIPP and Yucca Mountain (DOE 2002e)		11,000	6.6	50,000	30	ND
General transportation 1953-2037 (DOE 2002e)		270,000	162	230,000	138	36
New silt/clay source development (DOE 1997a)		Not applicable	Not applicable	Not applicable	Not applicable	0.13
Subtotal Other Actions		299,558	180	304,329	183	74
Consolidation EIS Alternatives [b]	No Action	15	0.009	22	0.013	0.036
	Consolidation	0.77	0.00046	0.43	0.00026	0.00042
	Consolidation with Bridge	1.48	0.00089	1.0	0.00060	0.00068
Total [c]		299,561 to 299,573	180	304,334 to 304,351	183	74

WIPP = Waste Isolation Pilot Plant.

[a] Traffic fatalities associated with transporting radioactive materials and waste.

[b] Transportation impact indicators from this Chapter 4.

[c] Total is a range that includes the minimum and maximum values from the *Consolidation EIS* alternatives. Total may not equal the sum of the contributions due to rounding.

Note: LCFs calculated using a conversion of 0.0006 LCFs per person-rem.

Facilities that involve shipment of radioactive materials were surveyed for 1971 through 1993 using accident data from the DOT, NRC, DOE, and state radiation control offices. During this period, there were 21 vehicular accidents involving 36 fatalities. These fatalities resulted from the vehicular accidents and were not associated with the radioactive nature of the cargo; no radiological fatalities due to transportation accidents have ever occurred in the United States (DOE 2002e). For perspective, it may be noted that several million traffic fatalities from all causes are expected nationwide during the period from 1943 to 2047 (DOE 2004a).

4.4.3.11 Waste Management

Expected cumulative waste generation at INL is presented in **Table 4–49**. It is unlikely that there would be major impacts on the waste management infrastructure at INL because the additional waste generated by the RPS production mission would generally be a small percentage of the total waste that would be generated.

The transuranic waste generated by RPS nuclear production operations would be certified for shipment to WIPP at the generating facility. Although transuranic waste is no longer routinely generated at INL, the 700 cubic meters (916 cubic yards) of transuranic waste that would be generated is a small percentage of the approximately 61,553 cubic meters (80,505 cubic yards) of transuranic waste in storage at INL. Therefore, the waste management infrastructure at INL would not be appreciably affected by this additional waste.

Although the volume of industrial waste previously disposed of in the INL landfill complex is unknown, it is estimated that the landfill complex would provide adequate capacity for the next 30 to 50 years, which would accommodate wastes generated for project life cycles evaluated in this cumulative impacts analysis (DOE 2002e).

Table 4–49 Cumulative Waste Generation at Idaho National Laboratory (cubic meters)

Activity (duration)		***Transuranic***	***LLW***	***MLLW***	***Hazardous***	***Nonhazardous***
Past, Present, and Reasonably Foreseeable Future Actions						
Existing site activities (35 years) [a]		0	224,000	8,050	29,225	2,170,000
Treatment and management of sodium-bonded spent nuclear fuel (12 years) (DOE 2000c, 2002d)		14	862	40	0	4,960
High-level radioactive waste and facility disposition (through 2035) (DOE 2002d, 2002e)		0	15,320	12,837	2,457	145,262
Advanced Mixed Waste Treatment Project (9 years) (DOE 1999b)		0	24	29,631	Not reported	Not reported
Subtotal Baseline Plus Other Actions		14	240,206	50,558	31,682	2,320,222
Consolidation EIS Alternatives [b]	No Action [c]	0	0	0	0	0
	Consolidation	700	7,525	189	8,050	5,215
	Consolidation with Bridge [c]	700	7,525	189	8,050	5,215
Total [d]		714	247,731	50,747	39,732	2,325,437

LLW = low-level radioactive waste, MLLW = mixed low-level radioactive waste.

[a] From Chapter 3 of this EIS. Assumes current waste generation rates will continue for 35 years.

[b] Waste generation values at INL for alternatives described in Chapter 4.

[c] Additional waste is generated at LANL and ORNL for these alternatives.

[d] Total is a range that includes the minimum and maximum values from the *Consolidation EIS* alternatives. Total may not equal the sum of the contributions due to rounding.

4.5 Mitigation Measures

This section summarizes the mitigation measures that could be used to avoid or reduce environmental impacts resulting from implementation of the alternatives as described in the preceding sections. As specified in CEQ's NEPA regulations (40 CFR 1508.20), mitigation includes:

- Avoiding the impact altogether by not taking an action or parts of an action;
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation;
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or

Compensating for the impact by replacing or providing substitute resources or environments.

As shown throughout Chapter 4, the impacts of the Consolidation and Consolidation with Bridge Alternatives would be small on most resources. Activities associated with the proposed construction and operations of the new RPS nuclear production facilities at MFC and INL would follow standard procedures and best management practices for minimizing environmental impacts. Therefore, no mitigation measures would be necessary for most resources.

Under the Consolidation and Consolidation with Bridge Alternatives, DOE would construct a new road between the MFC and ATR at INL to provide appropriate security measures for the transfer of unirradiated and irradiated targets and preclude the use of public roads. Three possible transportation routes for this new road were evaluated in this EIS. One route (T-3 route) while more direct, would require constructing a new bridge across the Big Lost River. This bridge would impact the floodplain and wetlands along the Big Lost River. The other routes would use an existing bridge crossing. A separate Preliminary Floodplain/Wetlands Assessment has been prepared for the T-3 route.

Following completion of this EIS and its associated Record of Decision, DOE would prepare a Mitigation Action Plan (if needed) that addresses mitigation commitments expressed in the Record of Decision. The Mitigation Action Plan would explain how certain measures would be planned, implemented, and monitored to mitigate those commitments. A Mitigation Action Plan would be prepared before DOE would undertake any activities that would require mitigation.

Proposed Mitigation Measures

- Adhere to standard best management practices for soil erosion and sediment control during construction (e.g., use of mulch and geotextiles to cover denuded areas) to minimize wind and water erosion.
- Reuse topsoil removed during construction for backfill of facility excavations.
- Water roadways and revegetate exposed areas to reduce dust emissions resulting from use of heavy equipment.
- Continue to implement the as low as is reasonably achievable (ALARA) principle during construction and operation to reduce radiological exposure of workers.
- Continue safety training to help protect workers and prepare for possible emergencies and accidents.
- Continue to perform cultural and biological surveys prior to and during construction.
- Provide physical improvements to local and onsite roads to increase capacity and reduce traffic volume impacts.
- Provide programs for employees that include flexible hours or staggered work shifts for workers to reduce peak traffic volumes.
- Continue implementing DOE's pollution prevention and waste minimization awareness program.

4.6 Resource Commitments

4.6.1 Unavoidable Adverse Environmental Impacts

Unavoidable adverse environmental impacts are impacts that would occur after implementation of all feasible mitigation measures, including those incorporated into the design elements of EIS alternatives. Implementing any of the alternatives considered in this EIS, including the No Action Alternative (status quo), would result in some unavoidable adverse environmental impacts.

Even with application of best management practices, some fugitive dust and noise generation, soil erosion, and increased vehicle traffic would be unavoidable during construction of the new road and the new RPS nuclear production facilities at MFC, but these impacts would be relatively minor and temporary in nature.

Geologic materials would be required for backfilling during excavation and new facility/road construction. Projections of the total volume of geologic resources required range from zero under the No Action Alternative to 307,000 cubic meters (402,000 cubic yards) under the Consolidation and Consolidation with Bridge Alternatives. The impacts of operating onsite borrow areas to support INL activities were previously addressed in the *Environmental Assessment and Plan for New Silt/Clay Source Development and Use at the Idaho National Engineering and Environmental Laboratory* (DOE 1997a). After extraction of geologic materials, borrow areas would be rehabilitated by grading and revegetating the land surface.

Minor unavoidable adverse impacts on air quality would occur due to emission of various chemical and radiological constituents from facility construction and operation. Under all alternatives, nonradiological emissions resulting from construction and operations are not expected to exceed National Ambient Air Quality Standards. Chemical and radiological emissions would not exceed the National Emission Standards for Hazardous Air Pollutants.

Unavoidable adverse impacts would occur due to land disturbance. Total land disturbance would range from zero under the No Action Alternative to 75 hectares (185 acres) under the Consolidation and Consolidation with Bridge Alternatives. Some plants and small animals would be killed during land clearing and excavation activities. Biological surveys conducted for MFC indicate that construction of the new RPS nuclear production facilities at MFC is not expected to disturb sensitive plants or animals, or alter or destroy sensitive habitat near MFC. A biological survey and consultations would be conducted before construction of the new road. No decision would be made relative to construction of any proposed facilities or the new road prior to completion of the consultation process. Although noise levels would be relatively low outside the immediate construction areas, the combination of noise and associated human activity probably would displace small numbers of animals surrounding the construction areas.

Normal facility operations would also result in unavoidable radiation exposure to workers and the general public. Workers would have the highest levels of exposure, but doses would be administratively controlled. The incremental annual dose contributions to the MEI, general population, and workers are discussed in the public and occupational health and safety–normal operations sections of this chapter. These doses are not expected to exceed any standards or administrative control limits.

Also unavoidable would be the generation of some waste products, including transuranic waste, low-level radioactive waste, mixed low-level radioactive waste, hazardous waste, and nonhazardous waste. Wastes generated during construction and operations would be collected, stored, and shipped for suitable treatment, recycling, or disposal in accordance with applicable Federal and State regulations as described in the waste management sections of this chapter. As described above, DOE would conduct all activities and optimize all operations in such a way that generates the smallest amount of waste practical.

4.6.2 Relationship between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

The construction and operation of facilities would result in short-term uses of the environment as described in this chapter. "Short term" for the purposes of analysis in this EIS is the active project phase during which construction and operations activities would take place. Under the No Action Alternative, this timeframe would encompass the 35-year active project period out to 2041. Under the Consolidation Alternative, this timeframe would include the 2-year construction, 1-year preoperational testing, and 35-year operations periods out to 2046. The Consolidation with Bridge Alternative would span the same timeframe as the Consolidation Alternative.

Implementation of the alternatives would necessitate short-term use of the environment and commitments of resources and would commit certain resources (e.g., land and energy) indefinitely or permanently. Certain short-term resource commitments would be substantially greater under the Consolidation and Consolidation with Bridge Alternatives than under the No Action Alternative due to construction of the new road and the new RPS nuclear production facilities at MFC. During operations, all of the alternatives would entail similar relationships between local short-term uses of the environment and the maintenance and enhancement of long-term productivity, with one exception. Resource commitments related to intersite transportation of materials would be greater under the No Action Alternative. These commitments are not likely to produce additional impacts on the long-term productivity of the terrestrial environment.

Air emissions associated with construction, operation, and deactivation of facilities would introduce small amounts of radiological and nonradiological constituents to the regional airshed around the sites. Over time, these emissions would result in additional loading and exposure, but are not expected to impact air quality or radiation exposure to the extent that the long-term productivity of the environment would be impaired.

Continued employment, expenditures, and tax revenues generated during implementation of any of the alternatives would directly benefit local, regional, and state economies over the short term. Local governments investing project-generated tax revenues into infrastructure and other required services could enhance economic productivity over the long term.

The management and disposal of transuranic waste, low-level radioactive waste, mixed low-level radioactive waste, hazardous waste, and nonhazardous waste would require an increase in energy and would consume space at treatment, storage, or disposal facilities. Regardless of the location, the use of land to meet waste disposal needs would be considered to be a reduction in the long-term productivity of the land.

Buildings would be committed to RPS production over the short term. After completion of their mission, DOE could decontaminate and decommission these facilities and restore the area such that it could be available for other future productive uses.

4.6.3 Irreversible and Irretrievable Commitments of Resources

This section describes the major irreversible and irretrievable commitments of resources that have been identified in this *Consolidation EIS*. A commitment of resources is irreversible when primary or secondary impacts limit the future options for a resource. An irretrievable commitment refers to the use or consumption of resources neither renewable nor recoverable for future use. In general, the commitment of capital, energy, labor, and materials would be irreversible.

The implementation of any of the alternatives considered in this EIS would entail the irreversible and irretrievable commitment of energy and fossil fuels, water, and chemicals. These resources would be committed over the entire life cycle of the activities described in this *Consolidation EIS* and would essentially be unrecoverable.

Table 4–50 presents the values for the major commitments of resources for construction and operation of the RPS Nuclear Production Facility and road along the northern most route at INL. Construction of the road along the northern most route would consume the most resources of the three potential routes, since the northern most route is the longest. The values are totals comprising requirements for construction and operation. Resource commitments during construction would be the same for both the Consolidation and Consolidation with Bridge Alternatives; there would be no construction under the No Action Alternative.

Table 4–50 Irreversible and Irretrievable Commitments of Resources for Construction and Operation of the New Radioisotope Power Systems Nuclear Production Facility and Road at Idaho National Laboratory [a]

Resource	*New Facilities and Road*
Utility/Energy Use	
Electricity (megawatt-hours)	309,600
Water (million liters)	1,690
Gasoline (liters)	983,447
Diesel fuel (million liters)	3.4
Propane (liters)	147,631
Construction Materials	
Concrete (cubic meters)	31,576
Crushed stone (cubic meters)	99,162
Sand and gravel (cubic meters)	4,511
Soil (cubic meters)	203,800
Steel (metric tons)	3,974
Asphalt (metric tons)	21,102
Lumber (board-feet)	5,990
Muriatic acid (liters)	4,561
Propylene glycol (liters)	23,091
Oxygen gas (cubic meters)	1,628
Acetylene gas (cubic meters)	433
Argon gas (cubic meters)	526
Nitrogen gas (cubic meters)	813

[a] Calculated as total alternative requirements encompassing the entire duration of the construction and operations periods.
Note: To convert from liters to gallons, multiply by 0.26418; from cubic meters to cubic yards, by 1.3079.
Source: INL 2005c.

Energy expended would be in the form of fuel for equipment, vehicles, and process operations and electricity for equipment and facility operations. As described elsewhere in this chapter, energy consumption to support activities under each alternative would be a small fraction of the total energy used at the sites. Electricity and fuels would be purchased from commercial sources. Water would be obtained via the site's existing water supply system. These resources are readily available, and the amounts required are not expected to deplete available supplies or exceed available system capacities.

Implementation of the Consolidation or Consolidation with Bridge Alternatives would require construction of a new facility for target fabrication and processing and for plutonium purification, pelletization, and encapsulation, and a new road at INL. The irreversible and irretrievable commitment of material resources includes construction materials that cannot be recovered or recycled, materials that are rendered radioactive and cannot be decontaminated, and materials consumed or reduced to unrecoverable forms of waste. Principal construction materials would include concrete, crushed stone, soil, steel, and asphalt, although other materials such as wood, sand, gravel, and other chemicals and gases would also be used. For practical purposes, concrete, steel, and other materials incorporated into the framework of new facilities would be unrecoverable and irretrievably lost, regardless of whether the materials would be directly contaminated. However, none of these identified construction resources is in short supply, and all are readily available in the INL region.

The new facilities and road would entail a commitment of land. Over the long term, the land that would be occupied by facilities could ultimately be returned to open spaces if buildings, roads, and other structures were removed, areas cleaned up, and the land revegetated. Alternatively, the facilities could be modified for use in other DOE programs. Thus, the commitment of such land is not necessarily irreversible over the long term.

Various materials and chemicals, including acids and caustics, would be required to support operations activities, including target fabrication and extraction and plutonium purification, pelletization, and encapsulation. These materials would be derived from commercial vendors, and their consumption is not expected to affect local, regional, or national supplies.

The treatment, storage, and disposal of transuranic waste, low-level radioactive waste, mixed low-level radioactive waste, hazardous waste, and nonhazardous waste would require the irretrievable commitment of energy and fuel and would result in the irreversible commitment of space in disposal facilities.